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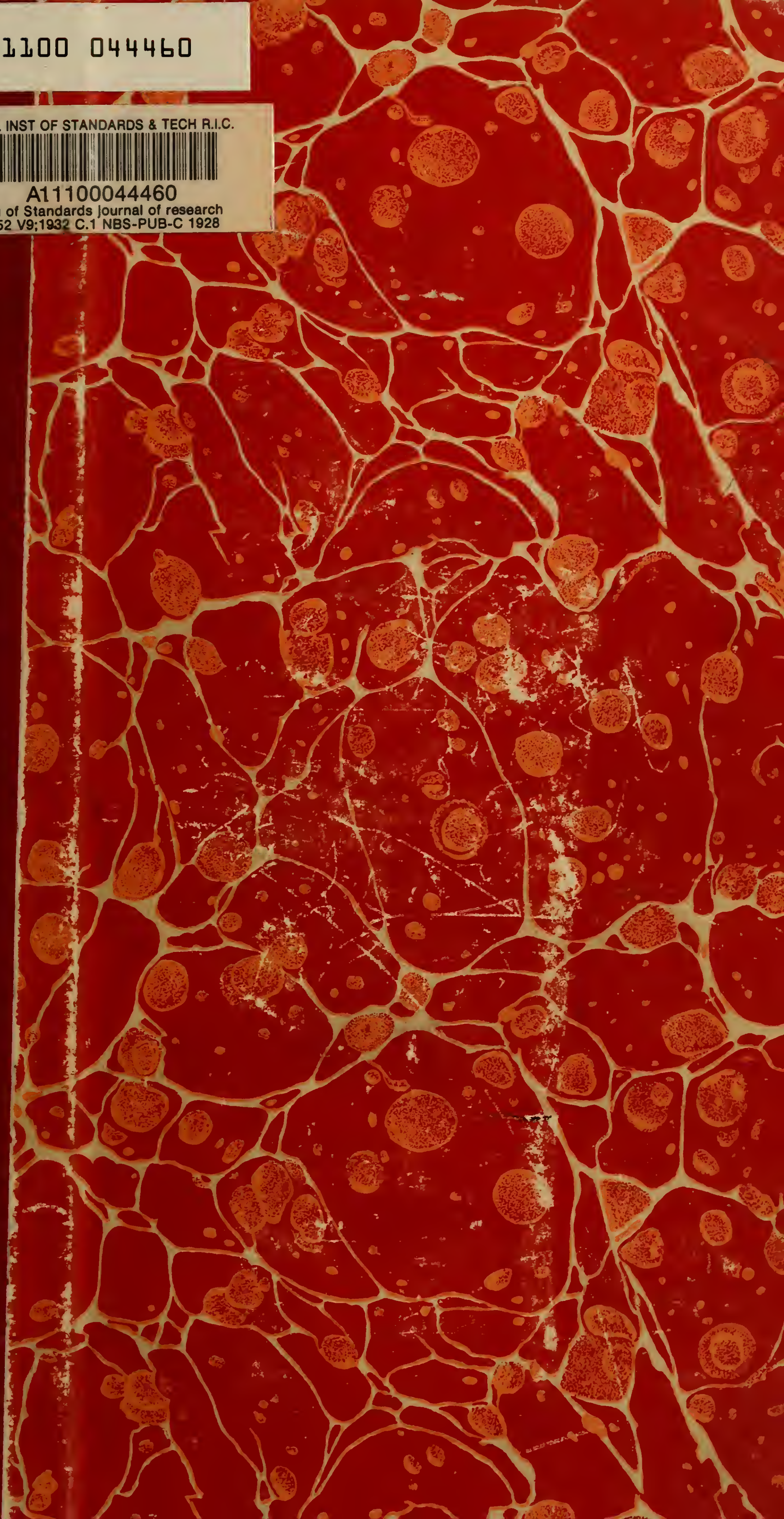

RP497

AN ANALYSIS OF LANTHANUM SPECTRA (LA I, LA II, LA III)

By Henry Norris Russell [1] and William F. Meggers

ABSTRACT

All the available data (wave-length measurements and intensity estimates, temperature classes, Zeeman effects) on lanthanum lines have been correlated and interpreted in an analysis of the successive optical spectra. The total number of lines classified is 540 in the La I spectrum, 728 in the La II spectrum, and 10 in the La III spectrum.

Series-forming terms have been identified in each spectrum and from these the ionization potentials of 5.59 volts for neutral La atoms, 11.38 volts for La^+ atoms and 19.1 volts for La^{++} atoms have been deduced.

Lanthanum is a chemical analogue of scandium and yttrium, but, although the corresponding spectra are strikingly similar, some interesting differences are noted. A doublet-D term (from a *d* electron) represents the lowest energy (normal state) in the third spectrum of each element and another ^2D (from the s^2d configuration) describes the normal state of the neutral atoms in each case. The homologous atoms Sc^+, Y^+, La^+ choose different normal states; $(sd)\ ^3D$, $(s^2)\ ^1S$, $(d^2)\ ^3F$, respectively. In addition, the first two spectra of La exhibit a large number of (odd) middle-set terms ascribed to the binding of an *f* electron. The La II spectrum is the most completely developed example of a two-electron spectrum which has yet been investigated. All the configuration types, s^2, sp, sd, sf, p^2, pd, pf, d^2, df, f^2, have been identified and almost all of the terms arising from each.

The analyses of all three spectra are supported by measurements of Zeeman effects, which are interpreted with the aid of Landé's theory. The splitting factors (*g* values) for many levels show marked departure from the theoretical values, but the "*g*-sum rule" is valid wherever it is tested.

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I. INTRODUCTION

After the analyses of the arc and spark spectra of scandium [2] (Sc, Z=21) and yttrium [3] (Y, Z=39) had been published the authors decided to continue cooperation on the remaining spectra of this type. Lanthanum (La, Z=57) is a chemical analogue of scandium and yttrium; it occupies the same position in the third long period of elements that the former do in the first and second long periods, respectively. The fact that lanthanum occupies a position in the periodic system just preceding the group of 14 elements commonly called "rare earths" makes a complete analysis of its spectra of exceptional interest. Indeed, this analysis shows (vide infra) that the atom building process which accounts for the rare earth elements is actually anticipated in the electron configurations of the lanthanum atom. Furthermore, the exact nature of electron coupling in complex atoms like La, as disclosed by the analysis of spectral structure, is certain to be important in the further development of theory. In the present paper the authors give the results of an extensive analysis of lanthanum spectra in practically the same form as their results for scandium and yttrium; the summary of spectral theory given in the earlier publications applies also to the present case, and the notation is the same except for slight changes which bring it into conformity with the standardized nomenclature [4] and practice.

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[1] Professor of astronomy, Princeton University.
[2] H. N. Russell and W. F. Meggers, B. S. Sci. Paper No. 558, vol. 22, p. 329, 1927.
[3] W. F. Meggers and H. N. Russell, B. S. Jour. Research, vol. 2 (RP55), p. 733, 1929.

In 1914, Popow [5] published the first suggestion of regularities in lanthanum spectra. From Zeeman effect observations, he recognized six La lines as comprising a combination of triplet P and triplet D terms. In the same year Paulson [6] published a list of constant differences occurring between wave numbers corresponding to La spark lines, but no attempt was made to interpret the regularities. Even earlier, Rybar [7] had made extensive measurements of the Zeeman effects in La spectra and many complex patterns were published, but there was at that time no satisfactory explanation for most of these. Another decade passed before the theory of complex Zeeman effects began to unfold itself in the work of Landé,[8] thus paving the way for an explanation of the La observations. An attempt was made in 1924 by Goudsmit [9] who identified additional Paulson terms in the La II spectrum with the aid of Rybar's Zeeman effects. From the latter observations the Landé *g* values and quantum numbers *j* and *l* were derived for 20 energy levels accounting for approximately 70 lines.

In the following year the theory of spectral terms as developed by Heisenberg [10] and by Hund [11] gave some important suggestions as to the structures of La spectra and attempts were made by one of us to extend the analysis of the La II spectrum and also to find regularities in the La I spectrum. These efforts succeeded with the availability of new empirical data consisting of a description of La lines with respect to their behavior with temperature in the electric furnace by King and Carter [12] and of unpublished Zeeman effects kindly advanced by Prof. B. E. Moore. The temperature classification gave a reliable separation of La I and La II lines, and the new observations of Zeeman effects, especially in the red portion of the spectrum, gave the first clue to regularities in the La I spectrum. In addition to the 20 levels identified by Goudsmit, 22 more were found for La$^+$ atoms and combinations of these 42 levels accounted for about 180 La II lines.[13] For neutral La atoms 48 energy levels were found and their combinations accounted for about 130 lines.[14] In both cases the normal states or lowest energy levels were identified without ambiguity, but in each spectrum many lines remained unclassified, and many theoretical terms were still undiscovered. These preliminary analyses indicated that it would be impossible to extend them without still further experimental data,[15] so it was decided to make an entirely new description of La spectra. Such a description was recently completed by one of us,[16] and it serves as a basis for the analyses of La spectra to be detailed in the present paper. In addition to new wave-length determinations for more than 1,500 La lines in the interval 2,100 to 11,000 A, the new data include intensity estimates of arc and spark lines, separating them into three classes, La I, La II, and La III spectra, and improved observations of Zeeman effects for 460 lines ranging from 2,700 to 7,500 A. These data have permitted us to classify almost all of the lines ascribed to lanthanum atoms, to identify a large majority of the spectral terms, and correlate them with electron configurations. In each case it has been possible to recognize series-forming terms, the extrapolation of which lead to calculated ionization potentials of 5.59 volts for neutral La atoms, 11.38 volts for La^+ atoms, and 19.1 volts for La^{++} atoms. The total numbers of classified lines in the successive spectra are as follows: 540 for La I, 728 for La II, and 10 for La III.

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[4] H. N. Russell, A. G. Shenstone, and L. A. Turner, Phys. Rev., vol. 33, p. 900, 1929.

[5] S. Popow, Ann. d. Physik., vol. 45, p. 147, 1914.

[6] E. Paulson, Ann. d. Physik., vol. 45, p. 1203, 1914.

[7] S. Rybar, Phys. Zeit. vol. 12, p. 889, 1911.

[8] A. Landé, Zeit. f. Physik., vol. 15, p. 189, 1923; vol. 16, p. 391, 1923; vol. 19, p. 112, 1923.

[9] S. Goudsmit, Kon. Akad. Wet. Amsterdam, vol. 33, No. 8, p. 774, 1924.

[10] W. Heisenberg, Zeit. f. Physik., vol. 32, p. 841, 1925.

[11] F. Hund, Zeit. f. Physik., vol. 33, p. 345, 1925. Linienspektren und periodisches system der Elemente, Julius, Springer, Berlin, 1927.

[12] A. S. King and E. Carter, Astrophys. J., vol. 65, p. 86, 1927.

[13] W. F. Meggers, J. Opt. Soc. Am., vol. 14, p. 191, 1927.

[14] W. F. Meggers, J. Wash. Acad. Sci., vol. 17, p. 25, 1927.

On account of the greater complexity of La spectra, as compared with Sc and Y, and pronounced departures from theoretical interval ratios, line intensities and Zeeman effects, their analysis has been attended by greater difficulties and uncertainties, but patience and perseverance have been rewarded by the final classification of practically all lines without ambiguity. The detailed results will be presented for La III, then for La II, and finally for La I, thus proceeding from the relatively simple (alkali) case of 1-valence electron to the 2-electron spectrum with greatly increased transition possibilities and lastly to the spectrum characteristics of atoms with a full complement of 3-valence electrons.

II. THE SPECTRUM OF DOUBLY IONIZED LANTHANUM (La III)

Lanthanum belongs to the third long period in which electron orbits of the types 6*s*, 6*p*, and 5*d* are successively added to the completed xenon shell. Only one valence electron remains in doubly ionized lanthanum and in the normal state this electron is in a 5*d* orbit which produces a ^2D term. The next lowest state occurs with the 6*s* orbit, and higher states arise from 6*p*, 6*d*, 7*s* orbits. Some of these terms were already identified by Gibbs and White [17] and recently Badami [18] classified eight lines of the La III spectrum.

The new description of La spectra yielded 10 lines which are characterized by an enormous intensity difference between arc and spark and are, therefore, ascribed to doubly ionized atoms. Analysis of these data resulted in the identification of spectral terms listed in Table 1; the observed lines and estimated relative intensities appear in Table 2.

The observed and theoretical (Landé) splitting factors (*g*) are compared in the last column of the term table. Since La spectra possess *g* values which depart more or less from Landé, the observed Zeeman effects in the table of classified lines are compared with those computed from observed rather than theoretical *g*'s. This procedure shows in the first table, the deviations of observed from theoretical g values, and in the second table how closely the observed data are represented by the empirical g values. The observed or computed Zeeman patterns may be compared with the theoretical by reference to "Tables of Theoretical Zeeman Effects" published by Kiess and Meggers.[19] These remarks apply to the La II and La I spectra (vide infra) as well as to La III.

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[15] W. F. Meggers, J. Wash. Acad. Sci., vol. 17, p. 35, 1927.

[16] W. F. Meggers, B. S. Jour. Research, vol. 9 (RP468), p. 239, 1932.

[17] R. C. Gibbs and H. E. White, Proc. Nat. Acad. Sci., vol. 12, p. 557, 1926; Phys. Rev., vol. 33, p. 157 1929.

[18] J. S. Badami, Proc. Roy. Soc. London, vol. 43, p. 53, 1931.

TABLE 1.—*Terms in the La III spectrum*

Electron configuration	Terms	Levels	Separations	g	
				Observed	Landé
5d	$5^2D_{1\frac{1}{2}}$	0.00	1,603.23		
	$5^2D_{2\frac{1}{2}}$	1,603.23			
6s	$6^2S_{\frac{1}{2}}$	13,590.76		2.10	2.000
6p	$6^2P_1{}^{\circ}{}_{\frac{1}{2}}$	42,014.92	3,095.72	.63	.667
	$6^2P^{\circ}_{1\frac{1}{2}}$	45,110.64		1.37	1.333
6d	$6^2D_{1\frac{1}{2}}$	82,378.75	433.76		
	$6^2D_{2\frac{1}{2}}$	82,812.51			
7s	$7^2S_{\frac{1}{2}}$	82,345.0			

It will be shown later that the terms arising from the $4f$ electron are higher than those from $6p$ in La I, but lower in La II. This suggested that the La III combinations $5d\ (^2D)$—$4f\ (^2F)$ might lie in the infra-red. The La spark spectrum in the interval 8,000 to 10,500 A was recently explored with xenocyanine plates, but no La III lines were found although La II lines were recorded all the way to 9,893.8 A.

TABLE 2.—*Classified lines in the La III spectrum*

λ(air) I. A.	Intensity	ν(vac) cm1	Term combinations	Zeeman effect	
				Observed	Computed
3,517.14	200	28,424.09	$6^2S_{\frac{1}{2}}-6^2P^{\circ}_{0\frac{1}{2}}$	(0.73)1.36	(0.74)1.36
3,171.68	300	31,519.94	$6^2S_{\frac{1}{2}}-6^2P^{\circ}_{1\frac{1}{2}}$	(0.37)**0.99**, 1.76	(0.36)**1.00**, 1.74
2,684.90	50	37,234.29	$6^2P^{\circ}_{1\frac{1}{2}}-7^2S_{\frac{1}{2}}$		
2,682.46	30	37,268.16	$6^2P^{\circ}_{1\frac{1}{2}}-6^2D_{1\frac{1}{2}}$		
2,651.60	300	37,701.87	$6^2P^{\circ}_{1\frac{1}{2}}-6^2D_{2\frac{1}{2}}$		
2,478.8[1]	20	40,329.9	$6^2P^{\circ}_{0\frac{1}{2}}-7^2S_{\frac{1}{2}}$		
2,476.72	100	40,363.79	$6^2P^{\circ}_{0\frac{1}{2}}-6^2D_{1\frac{1}{2}}$		
2,379.38	200	42,014.92	$5^2D_{1\frac{1}{2}}-6^2P^{\circ}_{0\frac{1}{2}}$		
2,297.75	200	43,507.40	$5^2D_{2\frac{1}{2}}-6^2P^{\circ}_{1\frac{1}{2}}$		
2,216.08	50	45,110.63	$5^2D_{1\frac{1}{2}}-6^2P^{\circ}_{1\frac{1}{2}}$		

[1] Near carbon line, 2,478.6 A.

III. THE SPECTRUM OF SINGLY IONIZED LANTHANUM (La II)

The spark spectrum of lanthanum is exceptionally complex; more than 800 lines appearing in spark spectrograms are associated with La^+ atoms. Superficially, the lanthanum spark spectrum resembles the yttrium spark spectrum; in each case the lines are divided roughly into two classes by comparison of arc and spark spectrograms. One group, including most of the stronger lines, has nearly the same appearance in a 6-ampere, 220-volt arc and in a high voltage condensed discharge, while the second, lying mainly in the ultra-violet, is greatly enhanced upon passing from the arc to the spark and consists largely of hazy and unsymmetrical lines. The former arise from combinations of low energy states with the next higher or middle set, while the latter are practically all identified as combinations of middle terms with a still higher third set.

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[19] C. C. Kiess and W. F. Meggers, B. S. Jour. Research, vol. 1 (RP23), p. 64, 1928.

The lowest energy states which can arise from *s* and *d* type electrons are identified with (even) spectral terms as follows:

Electron configuration	Spectral terms	
s^2	^{1}S	
sd	^{1}D	^{3}D
d^2	^{1}S,^{1}D,^{1}G	^{3}P ^{3}F

All of these have been identified except (d^2)^{1}S. Which particular term will be the lowest energy and represent the normal state of the atom depends on the relative strength of binding of the individual electrons. It is very remarkable that the homologous atoms, Sc^+, Y^+, and La^+, each make a different choice; the normal state of Sc^+ is (sd)^{3}D, of Y^+ (s^2)^{1}S, and of La^+ (d^2)^{3}F.

Substitution of a *p* electron for an *s* or a *d* electron produces the following set of (odd) middle terms:

Electron configuration	Spectral terms	
sp	^{1}P	^{3}P
dp	^{1}P,^{1}D,^{1}F	^{3}P,^{3}D,^{3}F

All of the easily excited lines of Sc^+ and Y^+ are accounted for by the above-mentioned low and middle spectral terms, but in the case of La^+ a large number of otherwise superfluous lines indicate additional middle-set terms to account for which it is necessary to conclude that *f*-type electrons are present. Thus, the substitution of *f*- for *p*-type electrons would yield the following additional (odd) middle-set terms:

Electron configuration	Spectral terms	
sf	^{1}F	^{3}F
df	^{1}P,^{1}D,^{1}F,^{1}G,^{1}H	^{3}P,^{3}D,^{3}F,^{3}G,^{3}H

All of these terms have been found in the La II spectrum, they increase the number of middle-set levels from 16 to 40 and thus account for the greater complexity of the spectrum.

The terms produced by the $4f$ electrons lie lower than those arising from the $6p$. This is obviously related to the fact that $4f$ electrons are bound into the normal state of the directly following elements, Ce to Lu, while the $6p$ electrons begin to be similarly bound only in Tl. In Ba I the *f* electron is much more loosely bound than the *p*. There are numerous high even terms in La II. Those arising from the configurations $5d\ 7s$, $5d\ 6d$, $6s\ 6d$, and $6p^2$ are homologous with similar terms in Sc II and Y II. Two important additional groups evidently arise from $6p\ 4f$ and $4f^2$. The former are the lowest of all the high even terms. Some hazy lines confined to the spark appear to be combinations between these and still higher odd levels which have been denoted by numbers 1° to 8°. There are several configurations (for example, $5d\ 7p$, $5d\ 5f$, $6p\ 6d$, $4f\ 6d$) which may give rise to levels of this sort, and they must be very numerous. They should combine with the ground terms to give lines in the

Schumann region. Observations in this region may detect many more such levels and thus lead to the interpretation of the remaining unclassified lines in the visible and near ultra-violet.

This is the most completely developed example of a 2-electron spectrum which has yet been investigated. All the configuration types, s^2, sp, sd, sf, p^2, pd, pf, d^2, df, f^2, have been identified and almost all of the terms arising from each. The theoretical relations of the terms arising from each configuration have been discussed by Condon and Shortley.[20] The agreement of the observed and computed levels is, in general, good, and their theoretical predictions led to the correct identification of the difficult terms $(df)^1\mathrm{H}$ and $(f^2)^1\mathrm{I}$.

The terms which have been identified in the La II spectrum are listed in Table 3, in which term symbols, relative values of the levels, level separations, adopted and Landé g values, and combining terms are given in successive columns. The adopted g values are derived from the observed Zeeman effects for La II lines starting with the completely resolved patterns and then applying the formulas of Shenstone and Blair[21] to the unresolved blends. For patterns which though unresolved had perpendicular (n) components distinctly shaded outwards (A^1) or inwards (A^2) the attempt was made to measure the points of maximum intensity corresponding to the strongest components. If x is the observed separation we should then have

$$x = J_1 g_1 - J_2 g_2 \quad (J_1 = J_2 + 1) \tag{1}$$

When no such asymmetry was noticed it was assumed that the settings were on the centroid of the whole pattern and the formula then used was

$$2x = (J_1 + 1) g_1 - J_2 g_2 \tag{2}$$

When $J_1 = J_2$ the equations are

$$2\,x = g_1 + g_2 \text{ (n components)} \tag{3}$$

$$4/3y = (J + 1/2)\ (1 - X)\ (g_1 - g_2) \quad \text{(p components)} \tag{4}$$

where $X = \frac{1}{(2J+1)^2}$ or $\frac{1}{4J\ (J+1)}$ according as J is integral or half integral.[22]

The weights assigned to the adopted g's in Table 3 depend on the number and consistency of the derived values. The probable error corresponding to unit weight is ±0.020.

Most of the g's have nearly the theoretical (Landé) values but marked discrepancies frequently appear which may be attributed to deviations of the actual coupling of the vectors from the ideal SL coupling for narrow multiplets. Some of the largest discordances are clearly due to "g sharing" among neighboring levels with the same J; for example, e^3G_4, e^3F_4; y^3D_1, y^3P_1, z^1P_1. In these cases the intensities of many combinations are also abnormal.

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[20] E. U. Condon and C. H. Shortley, Phys. Rev., vol. 37, p. 1025, 1931.
[21] A. G. Shenstone and H. A. Blair, Phil. Mag., vol. 8, p. 765, 1929.
[22] H. N. Russell, Phys. Rev., vol. 36, p. 1590, 1930.

TABLE 3.—*Relative terms in the La II spectrum*

Electron configuration	Term	Level	Level separations	*g*			Combinations
				Adopted	weight	Landé	
$5d^2$	a^3F_2	0.00	1,016.10	0.730	7½	0.667	$z^3F^\circ, z^1F^\circ, z^1G^\circ, y^3F^\circ, z^3H^\circ, z^1D^\circ, z^3G^\circ, z^3D^\circ, z^3P^\circ, y^1D^\circ, y^1F^\circ, y^3D^\circ, x^3F^\circ, z^1P^\circ, y^3P^\circ, x^3P^\circ, x^1F^\circ, x^1P^\circ$.
	a^3F_3	1,016.10	954.60	1.092	9	1.083	
	a^3F_4	1,970.70		1.258	8	1.250	
$6s5d$	a^1D_2	1,394.46		.987	10½	1.000	$z^3F^\circ, z^1F^\circ, y^3F^\circ, z^1D^\circ, z^3G^\circ, z^3D^\circ, z^3P^\circ, y^1D^\circ, y^1F^\circ, y^3D^\circ, x^3F^\circ, z^1P^\circ, y^3P^\circ, y^1P^\circ, x^3P^\circ, x^1F^\circ, x^1P^\circ$.
$6s5d$	a^3D_1	1,895.15	696.45	.520	13	.500	$z^3F^\circ, z^1G^\circ, y^3F^\circ, z^3H^\circ, z^1D^\circ, z^3G^\circ, z^3D^\circ, z^3P^\circ, y^1D^\circ, y^1F^\circ, y^3D^\circ, x^3F^\circ, z^1P^\circ, y^3P^\circ, y^1P^\circ, x^3P^\circ, x^1F^\circ, x^1P^\circ$.
	a^3D_2	2,591.60	658.75	1.140	8	1.167	
	a^3D_3	3,250.35		1.337	11	1.333	
$5d^2$	a^3P_0	5,249.70	468.42	0/0	6	0/0	$y^3F^\circ, z^1D^\circ, z^3D^\circ, z^3P^\circ, y^1D^\circ, y^1F^\circ, y^3D^\circ, x^3F^\circ, z^1P^\circ, y^3P^\circ, y^1P^\circ, x^3P^\circ, x^1F^\circ, x^1P^\circ$.
	a^3P_1	5,718.12	509.30	1.506	9	1.500	
	a^3P_2	6,227.42		1.488	11½	1.500	
$6s^2$	a^1S_0	7,394.57		0/0	4	0/0	$z^3D^\circ, z^3P^\circ, y^3D^\circ, z^1P^\circ, y^1P^\circ, x^3P^\circ, x^1P^\circ$.
$5d^2$	a^1G_4	7,473.32		1.003	2	1.000	$z^1G^\circ, y^3F^\circ, z^3H^\circ, z^3G^\circ, z^3D^\circ, y^1F^\circ, y^3D^\circ, x^3F^\circ, z^1H^\circ, x^1F^\circ$.
$5d^2$	b^1D_2	10,094.86		1.015	70	1.000	$z^3D^\circ, z^3P^\circ, y^1D^\circ, y^3D^\circ, x^3F^\circ, z^1P^\circ, y^3P^\circ, y^1P^\circ, x^3P^\circ, x^1F^\circ, x^1P^\circ$.
$6s4f$	$z^3F^\circ_2$	14,147.98	227.19	.676	7	.667	$a^3F, a^1D, a^3D, e^3G, e^3F, e^1F, e^3D, e^1G, f^3D, f^1F, f^3G, f^3F, g^3D, e^3H, g^3F, h^1D$.
	$z^3F^\circ_3$	14,375.17	323.57	1.087	10	1.083	
	$z^3F^\circ_4$	15,698.74		1.258	9	1.250	
$6s4f$	$z^1F^\circ_3$	15,773.77		1.047	10	1.000	$a^3F, a^1D, e^3G, e^3F, e^1F, e^3D, e^1G, e^1D, f^1D, f^3G, f^3F, g^3D, f^1G, e^3H, j^3F, h^1D, e^3D, i^1D$.
$5d4f$	$z^1G^\circ_4$	16,599.17		.996	4	1.000	$a^3F, a^3D, a^1G, e^3G, e^3F, e^1F, e^1G, f^1F, f^3G, f^1G, e^3H, g^3F, g^1G$.
$5d4f$	$y^3F^\circ_2$	17,211.93	1,023.63	.757	8	.667	$a^3F, a^1D, a^3D, a^3P, a^1G, e^3G, e^3F, e^3D, e^1G, e^1D, f^1D, f^1F, f^3G, g^3D, f^1G, g^3F, g^1G, h^1D, f^3P. i^1D$.
	$y^3F^\circ_3$	18,235.56	978.98	1.090	8	1.083	
	$y^3F^\circ_4$	19,214.54		1.243	6	1.250	
$5d\ 4f$	$z^3H^\circ_4$	17,825.62	754.79	.865	2	.800	$a^3F, a^3D, a^1G, e^3G, e^3F, e^1F, e^1G, f^3F, f^1G, e^3H\ g^3F, g^1G, e^1I$.
	$z^3H^\circ_5$	18,580.41	1,169.21	1.082	4	1.033	
	$z^3H^\circ_6$	19,749.62		1.17	1	1.167	
$5d\ 4f$	$z^1D^\circ_2$	18,895.41		.931	3½	1.000	$a^3F, a^1D, a^3D, a^3P, e^3G, e^3F, e^1F, e^3D, e^1D, f^3D, f^1F, f^3G, f^3F, g^3D, e^1P, e^3S, g^3F, h^1D, g^3P, h^3D, f^3P, i^1D$.
$5d\ 4f$	$z^3G^\circ_3$	20,402.82	928.78	.775	4	.750	$a^3F, a^1D, a^3D, a^1G, e^3G, e^3F, e^1F, e^3D, e^1D, f^3G, f^3F, g^1D, f^1G, e^3H, g^3F, g^1G$.
	$z^3G^\circ_4$	21,331.60	951.30	1.060	6	1.050	
	$z^3G^\circ_5$	22,282.90		1.203	5	1.200	
$5d\ 4f$	$z^3D^\circ_1$	21,441.73	664.29	.547	8	.500	$a^3F, a^1D, a\ ^3D, a^3P, a^1S, a^1G, b^1D, e^3G, e^3F, e^1F, e^3D, e^1G, e^1D, f^3D, f^1D, f^3G, f^3F, g^3D, e^1P, e^3S, e^3P, g^1D, f^1G, e^3H, g^3F, h^1D, g^3P, f^3P, i^1D$.
	$z^3D^\circ_2$	22,106.02	431.28	1.186	12	1.167	
	$z^3D^\circ_3$	22,537.30		1.317	10	1.333	
$5d\ 4f$	$z^3P^\circ_0$	22,683.70	21.45	0/0		0/0	$a^3F, a^1D, a^3D, a^3P, a^1S, b^1D, e^3D, e^1D, f^3D, f^1F, g^3D, e^1P, e^3S, e^3P, g^1D, g^3F, h^1D, g^3P, h^3D, f^3P, i^1D$.
	$z^3P^\circ_1$	22,705.15	541.78	1.458	7	1.500	
	$z^3P^\circ_2$	23,246.93		1.462	7	1.500	
$6p\ 5d$	$y^1D^\circ_2$	24,462.66		.897	7½	1.000	$a^3F, a^1D, a^3D, a^3P, b^1D, e^3G, e^3D, f^3D, f^1D, f^1F, f^3G, f^3F, y^3D, e^1P, e^3P, h^1D, f^3P, i^1D$.
$5d\ 4f$	$y^1F^\circ_3$	24,522.70		1.032	8	1.000	$a^3F, a^1D, a^3D, a^3P, a^1G, e^3G, e^1F, e^3D, e^1G, e^1D, f^1F, g^3D, g^1G, h^1D, g^3P, f^3P, i^1D$.
$6p\ 5d$	$y^3D^\circ_1$	25,973.37	1,414.74	.799	8	.500	$a^3F, a^1D, a^3D, a^3P, a^1S, a^1G, b^1D, e^3F. e^3D, e^1D, f^3D, f^3G, f^3F, g^3D, e^1P, e^3S, e^3P, g^1D, f^1G, e^3H, h^1D, g^3P, h^3D, f^3P, i^3D$.
	$y^3D^\circ_2$	27,388.11	927.14	1.191	10	1.167	
	$y^3D^\circ_3$	28,315.25		1.312	7	1.333	
$6p\ 5d$	$x^3F^\circ_2$	26,414.01	423.65	.836	7½	.667	$a^3F, a^1D, a^3D, a^3P, a^1G, b^1D, e^3G, e^3F, e^1F, e^3D, e^1D, f^3D, f^1D, f^1F, f^3G, f^3F, g^3D, e^1P, e^3S, g^1D, f^1G, e^3H, h^1D, g^3P, i^1D, i^3D$.
	$x^3F^\circ_3$	26,837.66	1,727.74	1.081	6	1.083	
	$x^3F^\circ_4$	28,565.40		1.246	4	1.250	
$5d\ 4f$	$z^1P^\circ_1$	27,423.91		.882	9	1.000	$a^3F, a^1D, a^3D, a^3P, a^1S, b^1D, e^1D, f^3D, f^1D, e^1P, e^3S, e^3P, e^1S, g^3P, g^1S, h^3D, f^3P, i^1D, f^1S$.
$5d\ 4f$	$z^1H^\circ_5$	28,525.71		1.00	1	1.000	$a^1G, e^1G, e^3H, g^1G, e^1I$.
$6p\ 5d$	$y^3P^\circ_0$	27,545.85	608.70	0/0		0/0	$a^3F, a^1D, a^3D, a^3P, b^1D, e^3D, f^3D, f^1D, g^3D, e^3S, e^3P, g^1D, g^3P, g^1S, h^3D, f^3P, i^1D, f^1S$.
	$y^3P^\circ_1$	28,154.55	1,343.50	1.262	5	1.500	
	$y^3P^\circ_2$	29,498.05		1.495	5	1.500	
$6p\ 5d$	$y^1P^\circ_1$	30,353.33		1.066	6	1.000	$a^1D, a^3D, a^3P, b^1D, e^1D, f^1D, f^3F, e^1P, e^3P, e^1S, g^1S, h^3D, i^1D, f^1S, {}^1D$?
$6s\ 6p$	$x^3P^\circ_0$	31,785.82	375.17	0/0		0/0	$a^3F, a^1D, a^3D, a^3P, a^1S, b^1D, f^3G, g^3D, e^1P, e^3S, e^1S, g^3P, h^3D, f^3P$.
	$x^3P^\circ_1$	32,160.99	1,043.42	1.515	6	1.500	
	$x^3P^\circ_2$	33,204.41		1.478	4	1.500	
$6p\ 5d$	$x^1F^\circ_3$	32,201.05		1.006	7	1.000	$a^3F, a^1D, a^3D, a^3P, a^1G, b^1D, f^3D, f^1D, f^1F, f^3G, f^1G, g^3F, g^1G, h^1D, i^1D, {}^1D$?
$6p\ 4f$	e^3G_3	35,452.66	1,720.13	.873	5	.750	$z^3F^\circ, z^1F^\circ, z^1G^\circ, y^3F^\circ, z^3H^\circ, z^1D^\circ, z^3G^\circ, z^3D^\circ, y^1D^\circ, y^1F^\circ, x^3F^\circ$.
	e^3G_4	37,172.79	1,845.95	1.146	7	1.050	
	e^3G_5	39,018.74		1.203	3	1.200	
$6p\ 4f$	e^3F_2	35,787.53	1,167.12	.732	5	.667	$z^3F^\circ, z^1F^\circ, z^1G^\circ, y^3F^\circ, z^3H^\circ, z^1D^\circ, z^3G^\circ, z^3D^\circ, y^3D^\circ, x^3F^\circ$.
	e^3F_3	36,954.65	835.92	1.061	7½	1.083	
	e^3F_4	37,790.57		1.141	7	1.250	
$6p\ 4f$	e^1F_3	37,209.71		.953	6	1.000	$z^3F^\circ, z^1F^\circ, z^1G^\circ, z^3H^\circ, z^1D^\circ, z^3G^\circ, z^3D^\circ, y^1F^\circ, x^3F^\circ$.
$6p\ 4f$	e^1G_4	39,221.65		1.060	6	1.000	$z^3F^\circ, z^1F^\circ, z^1G^\circ, y^3F^\circ, z^3H^\circ, z^3G^\circ, z^3D^\circ, y^1F^\circ, z^1H^\circ$.

TABLE 3.—*Relative terms in the La* II *spectrum*—Continued

Electron configuration	Term	Level	Level separations	g			Combinations
				Adopted weight		Landé	
$6p\,4f$	e^3D_1	38, 534. 11	−312. 62	0. 495	6	0. 500	$z^3F^\circ, z^1F^\circ, z^3F^\circ, z^1D^\circ, z^3G^\circ, z^3D^\circ, z^3P^\circ, y^1D^\circ, y^1F^\circ, y^3D^\circ, x^3F^\circ, y^3P^\circ.$
	e^3D_2	38, 221. 49		1. 100	7	1. 167	
	e^3D_3	39, 402. 55	1, 181. 06	1. 306	9	1. 333	
$6p\,4f$	e^1D_2	40, 457. 71		1. 046	5	1. 000	$z^1F^\circ, y^3F^\circ, z^1D^\circ, z^3G^\circ, z^3D^\circ, z^3P^\circ, y^1F^\circ, y^3D^\circ, x^3F^\circ, y^1P^\circ.$
$6s\,6p$	$x^1P^\circ_1$	45, 692. 17		. 97	1	1. 000	$a^3F, a^1D, a^3D, a^3P, a^1S, b^1D, i^1D.$
$5d\,7s$	f^3D_1	49, 733. 13	151. 22	. 520	3	. 500	$z^3F^\circ, z^1D^\circ, z^3D^\circ, z^3P^\circ, y^1D^\circ, y^3D^\circ, x^3F^\circ, z^1P^\circ, {}^3yP^\circ, x^1F^\circ.$
	f^3D_2	49, 884. 35	1, 344. 22	1. 141	3½	1. 167	
	f^3D_3	51, 228. 57		1. 331	3	1. 333	
$5d\,7s$	f^1D_2	51, 523. 86		1. 02	1½	1. 000	$z^1F^\circ, y^3F^\circ, z^3D^\circ, y^1D^\circ, x^3F^\circ, z^1P^\circ, y^3P^\circ, y^1P^\circ, x^1F^\circ.$
$5d\,6d$	f^1F_3	52, 137. 67		1. 00	1	1. 000	$z^3F^\circ, z^1G^\circ, y^3F^\circ, z^1D^\circ, z^3P^\circ, y^1D^\circ, y^1F^\circ, x^3F^\circ, x^1F^\circ.$
$5d\,6d$	f^3G_3	52, 857. 88	475. 49	. 89	1	. 750	$z^3F^\circ, z^1F^\circ, z^1G^\circ, y^3F^\circ, z^3G^\circ, x^3F^\circ, x^1F^\circ.$
	f^3G_4	53, 333. 37	1, 101. 28	1. 05	1	1. 050	
	f^3G_5	54, 434. 65		1. 20	1	1. 200	
$5d\,6d$	f^3F_2	53, 885. 24	954. 80	. 77	2	. 667	$z^3F^\circ, z^1F^\circ, z^3H^\circ, z^1D^\circ, z^3G^\circ, z^3D^\circ, y^1D^\circ, y^3D^\circ, x^3F^\circ.$
	f^3F_3	54, 840. 04	481. 31	1. 14	2	1. 083	
	f^3F_4	55, 321. 35		1. 16	2	1. 250	
$5d\,6d$	g^3D_1	52, 169. 66	565. 15	. 67	3	. 500	$z^1F^\circ, y^3F^\circ, z^1D^\circ, z^3D^\circ, z^3P^\circ, y^1D^\circ, y^1F^\circ, y^3D^\circ, x^3F^\circ, y^3P^\circ, x^3P^\circ.$
	g^3D_2	52, 734. 81	954. 75	1. 17	1	1. 167	
	g^3D_3	53, 689. 56		1. 21	3	1. 333	
$5d\,6d$	e^3S_1	54, 365. 80		1. 42	1	2. 000	$z^1D^\circ, z^3D^\circ, z^3P^\circ, y^3D^\circ, x^3F^\circ, z^1P^\circ, y^3P^\circ, y^1P^\circ, x^3P^\circ.$
$5d\,6d$	e^1P_1	53, 302. 56					$z^1D^\circ, z^3D^\circ, z^3P^\circ, y^1D^\circ, y^3D^\circ, x^3F^\circ, z^1P^\circ, y^1P^\circ, x^3P^\circ.$
$5d\,6d$	e^3P_0	54, 964. 19?					$z^3D^\circ, z^3P^\circ, y^1D^\circ, y^3D^\circ, z^1P^\circ, y^3P^\circ, y^1P^\circ.$
	e^3P_1	55, 230. 33	266. 14	1. 57	1	1. 500	
	e^3P_2	56, 036. 60	806. 27	1. 22	1	1. 500	
$5d\,6d$	f^1G_4	56, 035. 70		1. 03		1. 000	$z^1F^\circ, z^1G^\circ, y^3F^\circ, z^3H^\circ, z^3G^\circ, z^3D^\circ, y^3D^\circ, x^3F^\circ, x^1F^\circ.$
$5d\,6d$	g^1D_2	55, 184. 05		1. 08	1	1. 000	$z^3G^\circ, z^3D^\circ, z^3P^\circ, y^3D^\circ, x^3F^\circ, y^3P^\circ.$
$5d\,6d$	$e^1\,S_0$	54, 793. 82					$z^1P^\circ, z^3P^\circ.$
$4f^2$	e^3H_4	55, 107. 25	874. 84	. 94	1	. 800	$z^3F^\circ, z^1F^\circ, z^1G^\circ, z^3H^\circ, z^3G^\circ, z^3D^\circ, y^3D^\circ, x^3F^\circ, z^1H^\circ.$
	e^3H_5	55, 982. 09	855. 85	1. 04	2	1. 033	
	e^3H_6	56, 837. 94		1. 18	1	1. 167	
$4f^2$	g^3F_2	57, 399. 58	518. 92				$z^3F, z^1F^\circ, z^1G^\circ, y^3F^\circ, z^3H^\circ, z^1D^\circ, z^3G^\circ, z^3D^\circ, z^3P^\circ, x^1F^\circ.$
	g^3F_3	57, 918. 50	340. 91	1. 11	1	1. 083	
	g^3F_4	58, 259. 41		1. 22	1	1. 250	
$4f^2$	g^1G_{44}	59, 527. 60		1. 07	1	1. 000	$z^1G^\circ, y^3F^\circ, z^3H^\circ, z^3G^\circ, y^1F^\circ, z^1H^\circ, x^1F^\circ.$
$4f^2$	h^1D_2	59, 900. 08		1. 00	1	1. 000	$z^3F^\circ, z^1F^\circ, y^3F^\circ, z^1D^\circ, z^3D^\circ, z^3P^\circ, y^1D^\circ, y^1F^\circ, y^3D^\circ, x^3F^\circ, x^1F^\circ.$
$6p^2$	$f^3P^\circ_0$	60, 094. 84		0/0		0/0	$y^3F^\circ, z^1D^\circ, z^3D^\circ, z^3P^\circ, y^1D^\circ, y^1F^\circ, y^3D^\circ, z^1P^\circ, y^3P^\circ, x^3P^\circ.$
	f^3P_1	61, 128. 83	1, 033. 99	1. 47	1½	1. 500	
	f^3P_2	62, 506. 36	1, 377. 53	1. 45	1½	1. 500	
$6p^2$	i^1D_2	62, 026. 27					$z^1F^\circ, y^3F^\circ, z^1D^\circ, z^3D^\circ, z^3P^\circ, y^1D^\circ, y^1F^\circ, x^3F^\circ, z^1P^\circ, y^3P^\circ, y^1P^\circ, x^1F^\circ, x^1P^\circ.$
$4f^2$	e^1I_6	62, 408. 40		1. 01	1	1. 000	$z^3H^3, z^1H^\circ.$
$4f^2$	g^3P_0	63, 463. 95	239. 23				$z^1D^\circ, z^3D^\circ, z^3P^\circ, y^1F^\circ, y^3D^\circ, x^3F^\circ, z^1P^\circ, y^3P^\circ, x^3P^\circ.$
	g^3P_1	63, 703. 18	575. 74				
	g^3P_2	64, 278. 92					
$6s\,6d$	h^3D_1	64, 361. 28	168. 62				$z^1D^\circ, z^3P^\circ, y^3D^\circ, z^1P^\circ, y^3P^\circ, y^1P^\circ, x^3P^\circ.$
	h^3D_2	64, 529. 90	162. 69				
	h^3D_3	64, 692. 59					
	$^1D_2$?	64, 706. 76?					$y^1P^\circ, x^1F^\circ.$
$6p^2$	f^1S_0	66, 591. 91					$z^1P^\circ, y^3P^\circ, y^1P^\circ.$
$4f^2$	g^1S_0	69, 505. 06					$z^1P^\circ, y^3P^\circ, y^1P^\circ.$
$6d\,6s$	i^3D_3	69, 233. 90					$y^3D^\circ, x^3F^\circ.$
	1°_3	57, 364. 12					$e^3G, e^3F, e^3D.$
	2°_4	58, 748. 90					$e^3G, e^3F, e^1F.$
	$3^\circ_{3,2}$	59, 612. 64					$e^3G, e^3F, e^3D.$
	4°_4	60, 744. 17					$e^3G, e^3D.$
	$5^\circ_{4,3}$	61, 017. 66					$e^3F.$
	$6^\circ_{4,3}$	61, 514. 46					$e^1F, e^1G.$
	$7^\circ_{4,3}$	63, 598. 87					$e^3G, e^1G.$
	8°_3	64, 411. 17					$e^3G, e^1F, e^3D.$

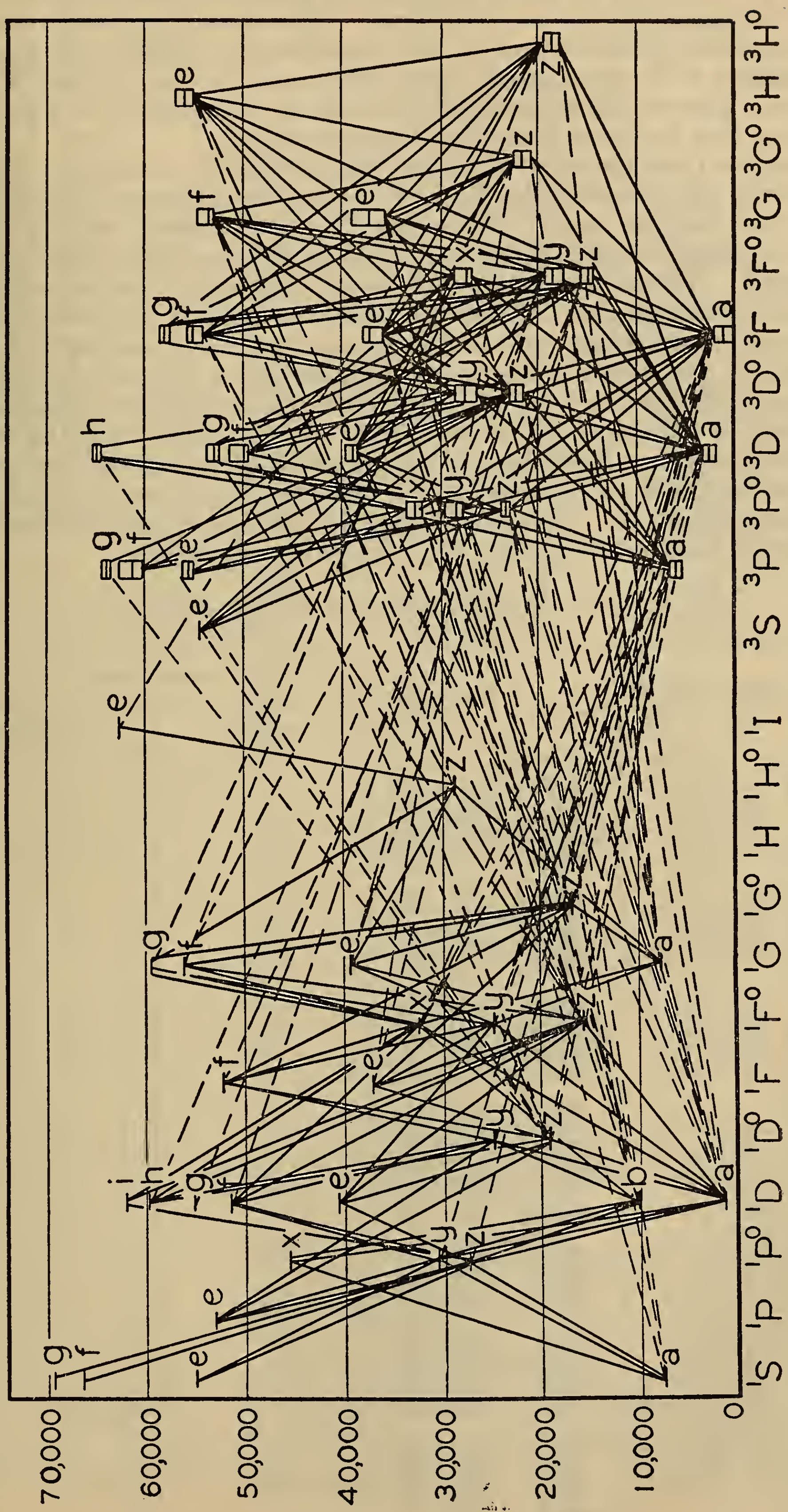

FIGURE 1.—*Terms and combinations in the La II spectrum*

A diagram of the La II terms and combinations is reproduced in Figure 1. In order to avoid making the figure too confusing some of the combinations have been omitted. The abundance and strength of intersystem connections is very striking in lanthanum spectra. Comparison with the corresponding diagrams for Sc II[23] and Y II[24] show at a glance the remarkable increase in complexity of the La II spectrum due to terms involving the *f*-electron.

Complete data for all of the observed lines characteristic of ionized lanthanum are presented in Table 4, successive columns of which contain wave lengths, spark intensities, furnace classes, vacuum wave numbers, term combinations, and Zeeman effects, both observed and computed. The latter are derived from the adopted *g* values with the formulas given above. When the observed pattern is resolved, the computed components are given separately; when unresolved, the centroid of the blend given by equations (2) or (4), except for the patterns described as A^1 or A^2, where the strongest component according to equation (1) is tabulated. In the latter case the measured position often deviates a little toward the centroid of the group. Apart from this the agreement of the observed and computed values is usually satisfactory. One faint line, 4,193.34 A is entirely discordant, and clearly does not arise from the assigned combination.

TABLE 4.—*The first spark spectrum of lanthanum (La II)*

λ_{air} I. A.	Intensity spark	Temperature class	ν_{vac} cm^{-1}	Term combinations	Zeeman effects	
					Observed	Computed
10, 954. 6	3		9, 126. 09	a^1G_4—$z^1G^\circ_4$		
10, 186. 5	2		9, 814. 2	$y^3D^\circ_1$—e^3F_3		
10. 093. 54	1		9, 904. 62	$y^3P^\circ_2$—e^3D_3		
9, 893. 82	4		10, 104. 55	$y^1P^\circ_1$—e^1D_2		
9, 672. 94	3		335. 29	$x^3F^\circ_3$—e^3G_4		
9, 657. 00	20		352. 35	a^1G_4—$z^3H^\circ_4$		
9, 563. 60	4		453. 45	$x^3F^\circ_4$—e^3G_5		
9, 346. 69	15		696. 04	$z^1H^\circ_5$—e^1G_4		
9, 260. 42	3		795. 69	$x^3F^\circ_2$—e^1F_3		
9, 146. 75	2		929. 85	$x^1F^\circ_2$—e^3G_3		
9, 127. 5	1		952. 9	$x^3F^\circ_3$—e^3F_4		
9, 101. 10	2		984. 67	a^3P_2—$y^3F^\circ_2$		
9, 096. 71	3		10, 989. 97	$y^1D^\circ_2$—e^3G_3		
9, 016. 80	2		11, 087. 37	$y^3D^\circ_3$—e^3D_3		
8, 810. 57	3		346. 89	f^1D_2—$z^3D^\circ_1$		
8, 781. 98	2		383. 83	$x^3F^\circ_3$—e^3D_2		
8, 650. 82	2		556. 43	a^3D_2—$z^3F^\circ_2$		
8, 514. 65	3		741. 24	a^1G_4—$y^3F^\circ_4$		
8, 484. 01	2		11, 783. 65	a^3D_2—$z^3F^\circ_3$		
8, 323. 35	1		12, 011. 10	b^1D_2—$z^3D^\circ_2$		
8, 159. 05	10? Spark.		252. 96	a^3D_1—$z^3F^\circ_2$		
8, 059. 5	3 h		404. 3	a^3F_4—$z^3F^\circ_3$		
7, 927. 83	2		610. 33	b^1D_2—$z^3P^\circ_1$		
7, 891. 69	2		668. 08	a^3P_2—$z^1D^\circ_2$		
79. 93	4		686. 98	$y^1F^\circ_3$—e^1F_3		
7, 838. 83	1		753. 50	a^1D_2—$z^3F^\circ_2$		
7, 740. 54	2 h		12, 915. 45	$z^3D^\circ_3$—e^3G_3		
7, 612. 94	3		13, 131. 92	a^3F_3—$z^3F^\circ_2$		
7, 489. 15	1		348. 98	a^3D_3—z^1G_4		
7, 483. 48	30	IV E	359. 10	a^3F_3—$z^3F^\circ_3$	(0.00) 1.12	(0.00) 1.09
7, 340. 08	2		620. 08	$x^3F^\circ_3$—e^1D_2		
7, 297. 99	2		698. 63	$y^1F^\circ_3$—e^3D_2		
82. 36	150	III E	728. 03	a^3F_4—$z^3F^\circ_4$	(0.00 w) 1.26	(0.00) 1.26
66. 13			758. 70	$y^1D^\circ_2$—e^3D_2		
7, 213. 95	2		13, 858. 22	a^1G_4—$z^3G^\circ_4$		

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[23] See footnote 2, p. 625.

[24] See footnote 3, p. 625.

TABLE 4.—*The first spark spectrum of lanthanum* (*La II*)—Continued

λ_{air} I. A.	Intensity spark	Temperature class	ν_{vac} cm^{-1}	Term combinations	Zeeman effects	
					Observed	Computed
7, 118. 6	2		14, 043. 8	$x^3F^\circ_2-z^1D_2$		
16. 8	3		047. 4	$a^1S_0-z^3D^\circ_1$		
7, 104. 7	3 h		071. 3	$y^1D^\circ_2-e^3D_1$		
7, 079. 74	4		120. 92	$z^3G_5-e^3G_3$		
7, 066. 24	300	III E	147. 90	$a^3F_2-z^3F^\circ_2$	(0.00) 0.70	(0.00) 0.70
6, 968. 78	25	V E	345. 76	$z^3D^\circ_1-e^3F_2$	(0. 00) 0.81	(0.00) 0.82
58. 11	100	IV E	367. 76	$b^1D_2-y^1D^\circ_2$	(0. 21) 0.96	(0.21) 0.96
54. 54	20	IV	375. 14	$a^3F_2-z^3F^\circ_3$		
52. 52	10	IV	379. 31	$a^1D_2-z^1F^\circ_3$	(0.00) 1.10	(0.00) 1.11
6, 902. 08	3	III	484. 40	$y^3D^\circ_1-e^1D_2$		
6, 859. 03	5	V	575. 31	$a^3D_3-z^3H^\circ_4$		
37. 91	15	IV ? E	620. 32	$a^3D_2-y^3F^\circ_2$		
34. 07	20	IV ? E	628. 54	$a^3F_4-z^1G^\circ_4$	(1.05) ?	(0.87) 1.13
30. 83	6	V E	635. 48	$z^3D^\circ_3-e^3G_4$	(0.00) 0.98	(0.00) 0.89
13. 68	50	V ? E	672. 32	$z^3D^\circ_3-e^1F_3$	(1.04) 1.29 B	(0.94) 1.14
08. 88	30	IV	682. 66	$a^3F_3-z^3F^\circ_4$	(0.00 h) 1.56 h	(0. 00) 1.51
6, 801. 38	5		698. 85	$y^1F^\circ_3-e^1G_4$	(0. 00) 1.10	(0.00) 1.10
6, 774. 28	100	III E	757. 65	$a^3F_3-z^1F^\circ_3$	(0.00 w) 1.10	(0.12) 1.07
50. 47	1		809. 70	$a^1G_4-z^3G^\circ_5$		
32. 80	40	V E	848. 57	$z^3D^\circ_2-e^3F_3$	(0. 00) 0.99	(0.00) 0.94
18. 68	60	V E	879. 78	$y^1F^\circ_3-e^3D_3$	(0.69) 1.12 B	(0.70) 1.17
6, 714. 08	80	V E	889. 97	$z^3G^\circ_5-e^3G_4$	(0. 00) 1.38	(0.00) 1.32
6, 676. 14	3		974. 59	$z^3P^\circ_2-e^3D_2$		
71. 41	40	IV ? E	14, 985. 20	$a^3D_3-y^3F^\circ_3$	(0.63) 1.17	(0.64) 1.21
42. 79	100	V E	15, 049. 77	$z^3G^\circ_3-a^3G_3$	(0. 33) 0. 82	(0.25) 0.82
36. 53	5	V	063. 96	$a^1G_4-z^3D^\circ_3$		
6, 619. 10	2		103. 63	$z^3D^\circ_2-e^1F_3$		
6, 570. 96	(?)	III	214. 28	$a^3P_2-z^3D^\circ_1$		
54. 18	(?)	V	253. 23	$z^3D^\circ_3-e^3F_4$		
29. 72	4 h	III ?	310. 37	$a^1S_0-z^3P^\circ_1$		
6, 526. 99	200	III E	316. 77	$a^3D_1-y^3F^\circ_2$	(0. 00, 0. 22) 0. 94 A^2	(0. 00, 0. 24) 0. 52, 0. 76, 0. 99
6, 498. 19	250	IV ? E	384. 66	$z^3G^\circ_3-e^3F_2$	(0. 00) 0. 81	(0. 00) 0. 82
46. 62	200	V E	507. 73	$z^3G^\circ_5-e^3F_4$	(0. 00 w) 1. 43 A^2	(0. 00) 1. 45 A^2
43. 05	50 h	V	516. 32	$z^3P^\circ_1-e^3D_2$	(0. 00 w) 0. 76 A^1	(0. 00) 0. 74 A^1
6, 415. 39	1		583. 22	$a^3F_3-z^1G^\circ_4$		
6, 399. 04	400	V ? E	623. 04	$z^3G^\circ_4-e^3F_3$	(0. 00) 1. 04	(0. 00) 1. 06
90. 48	200	III	643. 96	$a^3D_2-y^3F^\circ_3$	(0. 00) 1. 03	(0. 00) 1. 04
74. 08	30	V	684. 21	$z^3D^\circ_3-e^3D_2$	(0. 00 w) 1. 67 A^2	(0. 00) 1. 75 A^2
58. 12	30	IV	723. 58	$a^3P_1-z^3D^\circ_1$	(0. 99) 0. 49, 1. 52	(0. 96) 0. 54, 1. 51
37. 88	3	V	773. 79	$a^3F_2-z^1F^\circ_3$		
20. 39	200	III	817. 44	$a^1D_2-y^3F^\circ_2$	(0. 44) 0. 87 B	(0. 41) 0. 87
15. 79	50	V	828. 96	$z^3P^\circ_1-e^3D_1$	(0. 95) 0. 49, 1. 43	(0. 96) 0. 50, 1. 46
10. 91	200	V E	841. 20	$z^3G^\circ_4-e^3G_4$	(0. 27) 1. 10 B	(0. 29) 1. 10
07. 25	20 h	IV	850. 40	$z^3P^\circ_0-e^3D_1$	(0. 00) 0. 51	(0. 00) 0. 50
6, 305. 46	10	IV	854. 90	$a^3F_4-z^3H^\circ_4$		
6, 296. 08	300	IV E	878. 52	$\left\{\begin{matrix} b^1D_2-y^3D^\circ_1 \\ a^3P_2-z^3D^\circ_2 \end{matrix}\right.$	$\left.\right\}$(0. 00 w) 1. 20 A^2	(0. 00) 1. 23 A^2
73. 76	100	III ?	935. 01	$y^1F^\circ_3-e^1D_2$	(0. 00) 1. 04	(0. 00) 1. 02
62. 30	300	III	15, 964. 17	$a^3D_3-y^3F^\circ_4$	(0. 00 w) 1. 10 A^1	(0. 00) 0. 96 A^1
6, 203. 51	50 l	V	16, 115. 46	$z^3D^\circ_2-e^3D_2$	(0. 17) 1. 14 h	(0. 15) 1. 14
6, 188. 09	100 l	V	155. 61	$z^3P^\circ_2-e^3D_3$	(0. 00 w) 1. 02 A^1	(0. 00) 0. 99 A^1
74. 15	6	V	192. 09	$a^3P_0-z^3D^\circ_1$	(0. 00) 0. 63	(0. 00) 0. 55
72. 72	10	V	195. 84	$a^3F_3-y^3F^\circ_2$	(0. 00, 0. 32, 0. 63) 1. 69 A^2	(0. 00, 0. 34, 0. 67) 1. 76 A^2
46. 53	15	IV	264. 85	$a^3F_4-y^3F^\circ_3$	(0. 00 w) 1. 69 A^2	(0. 00) 1. 76 A^2
1. 92	1		303. 60	$a^3D_2-z^1D^\circ_2$		
29. 57	50	IV ?	309. 85	$a^3P_2-z^3D^\circ_3$	(0. 00 w) 0. 99 A^1	(0. 00) 0. 98 A^1
26. 09	50	V ?	319. 12	$b^1D_2-x^3F^\circ_2$	(0. 34) 0. 92 B	(0. 32) 0. 93
20. 34	1	IV	334. 45	$x^1P^\circ_1-i^1D_2$		
6, 100. 37	30	V	387. 92	$a^3P_1-z^3D^\circ_2$	(0. 00, 0. 34) 0. 84, 1. 16	(0. 00, 0. 32) 0.86,1.19, 1. 51
6, 085. 43	10	V	428. 15	$z^3D^\circ_2-e^3D_1$	(0. 00, 0. 74) 1. 20, 1. 90	(0. 00, 0. 69) 0.50,1.19, 1. 88
74. 01		III A	459. 04	$z^3G^\circ_4-e^3F_4$	(0. 21) 1. 12	(0. 27) 1. 10

TABLE 4.—*The first spark spectrum of lanthanum (La II)*—Continued

λ_{air} I. A.	Intensity spark	Temperature class	ν_{vac} cm^{-1}	Term combinations	Zeeman effects	
					Observed	Computed
67. 13	6	V ?	477. 71	$a^3P_2-z^3P_1^\circ$	(0. 00) 1. 49	(0. 00) 1. 50
61. 42	2	V ?	493. 23			
46. 07	2	IV ?	535. 10			
6, 037. 98	2		557. 25	$z^1D_2^\circ-e^3G_3$		
5, 991. 98	4 h		684. 36	$z^3D_3^\circ-e^1G_4$		
73. 52	120 l	V E	735. 92	$z^3G_5^\circ-e^3G_5$	(0. 00) 1. 20	(0. 00) 1. 20
71. 09	8		742. 73	$b^1D_2-x^3F_3^\circ$	(0. 00) 1. 18	(0. 00) 1. 15
61. 43	3		769. 86	$z^3G_3^\circ-e^3G_4$		
57. 90	4		779. 80	$z^3D_1^\circ-e^3D_2$		
48. 30	20		806. 9	$z^3G_3^\circ-e^1F_3$	(0. 52) 0. 86 h	(0. 46) 0. 86
36. 22	20	V E	841. 08	$a^1D_2-y^3F_3^\circ$	(0. 00) 1. 21	(0. 00) 1. 19
27. 71	30		865. 26	$z^3D_3^\circ-e^3D_3$	(0. 00) 1. 30	(0. 03) 1. 31
18. 26	4		892. 19	$z^1D_2-e^3F_2$		
5, 901. 95	40 l	IV E	938. 87	$z^3G_5^\circ-e^1G_4$	(0.00 w) 1.60 A^2	(0.00) 1.78 A^2
5, 892. 66	4	V	965. 58	$a^3P_1-z^3P_0$	(0.00) 1.54	(0.00) 1.51
85. 23	1		16, 986. 99	$a^3P_1-z^3P_1^\circ$		
80. 63	50	III E ?	17, 000. 28	$a^3D_1-z^1D_2^\circ$	(0. 00, 0.42) 0.54, 0.96, 1. 38	(0. 00, 0.41) 0.52, 0.93, 1. 34
74. 00	6	IV	019. 47	$a^3P_2-z^3P_2^\circ$	(0.00) 1.49	(0.05) 1.48
63. 70	80	V E	049. 36	$a^1G_4-y^1F_3^\circ$	(0.00) 0.96	(0.00) 0.96
48. 95	20		092. 36	$z^3D_1^\circ-e^3D_1$	(0.00) 0.54	(0.05) 0.52
28. 44	2		152. 51	$a^3D_3-z^3G_3^\circ$		
08. 63	8		211. 00	$z^3P_2^\circ-e^1D_2$		
08. 31	60	IV ?	211. 95	$a^3F_2-y^3F_2^\circ$	(0.00) 0.75	(0.05) 0.74
06. 56	8		217. 14	$y^3F_3^\circ-e^3G_3$		
5, 805. 77	120	III E	219. 48	$a^3F_3-y^3F_3^\circ$	(0.00) 1.09	(0.00) 1.09
5, 797. 57	150	III E	243. 84	$a^3F_4-y^3F_4^\circ$	(0.00) 1.24	(0.05) 1.25
81. 02	3		293. 20	$b^1D_2-y^3D_2^\circ$		
79. 91	4		296. 52	$z^3D_2^\circ-e^3D_3$	(0.00) 1.38 h	(0.00) 1.43
69. 06	60	V E	329. 05	$b^1D_2-z^1P_1^\circ$	(0.00) 1.09	(0.00) 1.08
49. 59	2		387. 73	$z^3G_3^\circ-e^3F_4$		
27. 29	20	V E	455. 43	$a^3P_0-z^3P_1^\circ$	(0.00) 1.45	(0.00) 1.46
12. 39	20	III E ?	500. 96	$a^1D_2-z^1D_2^\circ$	(0.00) 0.98	(0.10) 0.96
5, 703. 32	20	III	528. 80	$a^3P_1-z^3P_2$	(0.00) 1.48	(0.00) 1.44
5, 671. 54	100	V E	627. 02	$z^3H_4^\circ-e^3G_3$	(0.00) 0.79	(0.00) 0.85
52. 3	10 h		687. 0	$z^3G_4^\circ--e^3G_5$		
5, 610. 53	20		818. 69	$z^3G_3^\circ-e^3D_2$		
5, 591. 51	1		879. 30	$a^3F_3-z^1D_2^\circ$		
66. 92	40	V E	17, 958. 28	$y^3F_4^\circ-e^3G_4$	(0. 37) 1. 24	(0. 32) 1. 20
47. 56	3 h		18, 020. 95		(0. 00) 1. 13	
35. 66	80	V E	059. 69	$b^1D_2-y^3P_1^\circ$	(0. 00 w) 0. 80 A^1	(0. 00) 0. 77 A^1
5, 532. 17	10	III	071. 08	$z^3G_4^\circ-e^3D_3$	(0. 00 w) 0. 61 h	(0. 00) 0. 69
5, 493. 45	20	V E	198. 45	$a^3F_3-y^3F_4^\circ$	(0. 00 w) 1. 57 A^2	(0. 00) 1. 70 A^2
86. 86	5	V	220. 31	$b^1D_2-y^3D_3^\circ$		
82. 27	40	V E	235. 57	$a^3F_2-y^3F_3^\circ$	(0. 00 w) 1. 89 A^2	(0. 00) 1. 81 A^2
80. 72	25	V E	240. 72	$y^3F_2^\circ-e^3G_3$	(0. 00) 1. 03 h	(0. 00) 0. 99
64. 37	25	V E	295. 30	$a^3P_2-y^1F_3^\circ$	(0. 00, 0. 49, 0. 97) 0. 00 d, 0. 49, 0. 97	(0. 00, 0. 46, 0. 91) 0. 12, 0. 57, 1. 03
58. 68	50	V E	314. 37	$z^1D_2^\circ-e^1F_3$	(0. 00) 1. 00	(0. 00) 0. 98
47. 59	10		351. 65	$z^3D_2^\circ-e^1D_2$	(0. 22) 1. 14	(0. 25) 1. 12
5, 423. 82	4		432. 08	$a^3F_4-z^3G_3^\circ$		
5, 381. 91	100	V E	575. 61	$y^3F_2^\circ-e^3F_2$	(0. 00) 0. 74	(0. 00) 0. 72
81. 77	50	V E	576. 10	$z^3F_4^\circ-e^3F_4$		
80. 97	100	V E	578. 86	$a^1S_0-y^3D_1^\circ$	(0. 00) 0. 77	(0. 00) 0. 80
77. 08	200	V E	592, 30	$z^3H_5^\circ-e^3G_4$	(0. 00 w) 0. 82 A^1	(0. 00) 0. 83 A^1
40. 66	100	III E	719. 09	$y^3F_3^\circ-e^3F_3$	(0. 00) 1. 07	(0. 08) 1. 08
33. 42	2		744. 50	$a^3P_1-y^1D_2$		
03. 54	100	III E	850. 10	$a^3D_2-z^3D_1^\circ$	(0. 00, 0. 61) 0. 57, 1. 17, 1. 78	(0. 00, 0. 59) 0. 55, 1. 14, 1. 73
02. 62	150	V E	853. 37	$z^1G_4^\circ-e^3G_3$	(0. 00) 1. 16	(0. 00) 1. 18
5, 301. 97	200	III E	855. 68	$a^3D_3-z^3D_2^\circ$	(0.00 w) 1.50 w	(0.00) 1.49
5, 290. 83	50	III E	895. 38	$a^3F_2-z^1D_2^\circ$	(0.34) 0.82 B	(0.36) 0.83
79. 11	40	V E	18, 937. 33	$y^3F_3-e^3G_4$	(0.00) 1.20	(0.00) 1.23
59. 38	50	III E	19, 008. 37	$a^1D_2-z^3G_3^\circ$	(0.00 w) 0.46 A^1	(0.00) 0.35 A^1
57. 28	2		015. 96	$z^3D_1^\circ-e^1D_2$		
26. 20	40 l	V E	129. 05	$z^3H_4^\circ-e^3F_3$	(0.00 w) 0.32 w	(0.00) 0.28 A^1
22. 48	3 h		142. 68	$e^3D_2-1_3^\circ$	(0.00) 1.15	
21. 32	3 h		146. 93			

TABLE 4.—*The first spark spectrum of lanthanum (La II)*—Continued

λ_{air} I. A.	Intensity spark	Temperature class	ν_{vac} cm^{-1}	Term combinations	Zeeman effects	
					Observed	Computed
17.83	10 h		159.74			
5,204.14	300	V E	210.14	$z^3H^\circ_5-e^3F_4$	(0.00) 0.86 A^1?	(0.00) 0.85 A^1
5,191.50	3 h		256.91		(0.00) 1.05	
88.21	500	V E	269.12	$z^3H^\circ_6-e^3G_5$	(0.00) 1.09	(0.00) 1.09
83.42	400	III E	286.93	$a^3D_3-z^3D^\circ_3$	(0.00) 1.31	(0.05) 1.33
73.83	25 l	IV ? E	322.67	$x^1F^\circ_3-f^1D_2$	(0.00) 1.06	(0.00) 0.99
72.89	20 l	V E	326.19	$z^1D^\circ_2-e^3D_2$	(0.20 1.03	(0.30) 1.02
67.28	10		347.17	$z^3H_4-e^3G_4$		
63.61	40	V ? E	360.92	$a^3F_4-z^3G^\circ_4$	(0.74) 1.18 B	(0.66) 1.16
62.68	3		364.41	$a^1G_4-x^3F^\circ_3$		
57.43	150	V E	384.12	$z^3H^\circ_4-e^1F_3$	(0.00) 0.66	(0.00) 0.73
56.74	40	V E	386.71	$a^3F_3-z^3G^\circ_3$		
52.31	1		403.38	$b^1D_2-y^3P^\circ_2$		
22.99	200	III E	514.43	$a^3D_2-z^3D^\circ_2$	(0.00) 1.16	(0.08) 1.16
14.55	200	III ? E	546.63	$a^3D_1-z^3D^\circ_1$	(0.00) 0.54	(0.03) 0.53
12.37	2		554.97	$y^3F^\circ_3-e^3F_4$		
5,107.54	6 h		573.46	$e^3F_4-1^\circ_3$	(0. 00) 1.19	
5,090.56	20 l	V E	638.74	$z^1D^\circ_2-e^3D_1$	(0.00 w) 1.33 A^2	(0.00) 1.37 A^2
86.71	3 hl		653.61	$x^3P^\circ_2-f^3G_3$		
80.21	40	V E	678.76	$z^1F^\circ_3-e^3G_3$	(0.38) 0.98 w	(0.45) 0.96
66.99	20 h		730.10	$e^3G_5-2^\circ_4$	(0.00) 1.10 h	
63.76	3		742.68	$y^3F^\circ_2-e^3F_3$		
62.91	20	V E	746.00	$a^3P_2-y^3D^\circ_1$	(0.00, 0.66) 0.90, 1.56, 2.22	(0.00, 0.69) 0.80, 1.49, 2.18
60.85	3		754.04	$z^3F^\circ_4-e^3G_3$		
58.56	1 h		762.97			
48.04	30 l	V E	804.16	$y^3F^\circ_4-3^3G_5$	(0.00) 1.16	(0.00) 1.12
14.45	30 hl		936.82	$x^1F^\circ_3-f^1F_3$		
5,002.12	40	V E	985.96	$y^3F^\circ_3-e^3D_2$	(0.00) 1.09	(0.00) 1.08
4,999.46	200	III E	19,996.60	$a^3D_3-z^3P^\circ_2$	(0.00 w) 1.28 A^2	(0.00) 1.08 A^1
96.82	50	V E	20,007.16	$y^3F^\circ_4-e^1G_4$		
95.17	1		013.77	$z^1F^\circ_3-e^3F_2$		
91.27	80	IV E	029.41	$a^1S_0-z^1P^\circ_1$	(0.00) 0.85	(0.00) 0.88
86.82	100	III E	047.28	$a^1D_2-z^3D^\circ_1$	(0.00, 0.43) 0.57, 1.00, 1.43	(0.00, 0.44) 0.55, 0.99, 1.43
74.20	4 h		098.14	$x^3P^\circ_2-e^1P_1$		
70.39	100	III E	113.55	$a^3D_2-z^3P^\circ_1$	(0.00, 0.29) 0.83, 1.12 us	(0.00, 0.32) 0.82, 1.14, 1.46
56.04	2	V	171.79			
52.06	40	V E	188.00	$y^3F^\circ_4-e^3D_3$	(0.00) 1.17.	(0.00) 1.15
46.47	50	IV?E	210.81	$a^3D_1-z^3D^\circ_2$	(0.00, 0.67) 1.15, 1.82	(0.00, 0.67) 0.52, 1.19, 1.85
35.61	10	V E	255.28	$a^3P_1-y^3D^\circ_1$		
34.83	100	V E	258.48	$b^1D_2-y^1P^\circ_1$	(0.00) 0.97	(0.00) 0.99
21.80	300	III E	312.12	$a^3F_4-z^3G^\circ_5$	(0.00) 1.11	(0.00) 1.09
20.98	300	III E	315.50	$a^3F_3-z^3G^\circ_4$	(0.00) 1.00	(0.00) 0.92
11.34	10		355.38	$z^1G^\circ_4-e^3F_3$		
4,904.43	2 h		384.05	$x^3P^\circ_0-g^3D_1$		
4,899.92	200	III E	402.82	$a^3F_2-z^3G^\circ_3$	(0.00) 0.80	(0.00) 0.82
91.43	10		438.23	$z^3H_5-e^3G_5$		
80.20	10 h		485.17	$x^3P^\circ_2-g^3D_3$		
74.99	1		507.15	$z^1D_2-e^3D_3$		
60.90	80	III E	566.59	$a^3F_4-z^3D^\circ_3$	(0.00) 1.19	(0.00) 1.17
59.18	5 h		573.87	$z^1G^\circ_4-e^3G_4$ $z^3P^\circ_1-z^3D_2$		
50.58	30	V E	610.35	$a^3P_2-x^3F^\circ_3$ $z^1G_4-e^1F_3$	(0.00) 1.03	(0.00) 1.06
43.29	5	V	641.37			
40.02	30	V E	655.32	$a^3D_2-z^3P^\circ_2$	(0.67) 1.30 ?	(0.58) 1.30
30.51	10	V E	695.98	$a^3P_1-x^3F^\circ_2$	(0.00) 0.76 R	(0.00, 0.67) 0.17, 0.84 1.51
26.87	20	V E	711.59	$a^1D_2-z^3D^\circ_2$	(0.33) 1.08 R	(0.36) 1.09
24.05	100	III E	723.70	$a^3P_0-y^3D^\circ_1$	(0.00) 0.79	(0.00) 0.80
09.00	100	V E	788.55	$a^3D_1-z_3P^\circ_0$	(0.00) 0.51	(0.00) 0.52
4,804.04	80	V E	810.02	$a_3D_1-z_3P^\circ_1$	(0.95) 0.49, 1.43	(0.94) 0.52, 1.46
4,796.67	25	V E	841.99	$a^1G_4-y_3D^\circ_3$		
94.55	3	V E	851.20			

TABLE 4.—*The first spark spectrum of lanthanum (La* II)—Continued

λ_{air} I. A.	Intensity spark	Temperature class	ν_{vac} cm^{-1}	Term combinations	Zeeman effects	
					Observed	Computed
80.55	2	V	20,912.27			
58.40	3		21,009.61	$y^3F^\circ_2$—e^3D_2		
48.73	150	V E	052.39	a^1G_4—$z^1H^\circ_5$	(0.00) 1.00	(0.00) 0.99
43.08	250	V E	077.47	$z^3F^\circ_3$—e^3G_3	(0.52 w) 0.95 B	(0.55) 0.98
40.27	120	III E	089.96	a^3F_3—$z^3D^\circ_2$	(0.00 w) 0.97 A^1	(0.00) 0.90 A^1
39.80	15	V E	092.06	a^1G_4—x^3F_4		
30.73	3 h		132.50	$x^1F^\circ_3$—f^3G_4		
28.41	100	V E	142.86	a^1D_2—$z^3D^\circ_3$	(0.00, 0.32) 1.31, 1.61, 1.91	0.00, 0.33, 0.66)—, —, 1.32, 1.65, 1.99
24.42	40	V E	160.72	a^3P_2—$y^3D^\circ_2$	(0.65) 0.95 us	(0.30, 0.59) 0.89, 1.19, 1.49, 1.78
22.14	2 h		170.94	$y^1P^\circ_1$—f^1D_2		
19.93	150	V E	180.85	$z^1F^\circ_3$—e^3F_3	(0.00) 1.06	(0.00) 1.05
17.58	50	V E	191.40	$z^1G^\circ_4$—e^3F_4	(0.50) 1.2	(0.48) 1.07
16.44	80	V E	196.52	a^3P_2—$z^1P^\circ_1$	(0.00, 0.60) 0.92, 1.52, 2.12	(0.00, 0.61) 0.88, 1.49 2.09
12.92	40	V E	212.35	a^3D_3—$y^1D^\circ_2$	(0.00, 0.47, 0.92) 1.83, 2.26 R	(0.00, 0.44, 0.88) —,—,—, 1.78, 2.22
4,703.27	150	V E	255.87	$z^3F^\circ_4$—e^3F_3	(0.00 w) 1.70 A^2	(0.00) 1.85 A^2
4,699.62	50	V E	272.38	a^3D_3—$y^1F^\circ_3$		
92.50	200	V E	304.66	$z^3F^\circ_2$—e^3G_3	(0.00 w) 1.21 A^2	(0.00) 1.26 A^2
91.17	50	V E	310.70	a^1D_2—$z^3P^\circ_1$	(0.00, 0.46) 0.46 us	(0.00, 0.47) 0.51, 0.99, 1.46
88.65	40	V E	322.15	$y^3F^\circ_2$—e^3D_1	(0.00) 0.96	(0.00) 0.89
84.39	2 h		341.54	e^3D_3—4°_4		
82.12	5		351.89	a^3D_1—$^{23}P^\circ_2$		
73.53	1 h		391.14	e^3D_2—$3^\circ_{3,2}$		
71.82	200	V E	398.96	$z^1F^\circ_3$—e^3G_4	(0.00 w) 1.29 h	(0.00) 1.30
68.91	250	V E	412.30	$z^3F^\circ_3$—e^3F_2	(0.00, 0.34, 0.68) 0.77, 1.12 1.47, 1.81 us	(0.00, 0.36, 0.71) —, —, 0.73, 1.09, 1.44, 1.80
63.76	300	V E	435.94	$z^1F^\circ_3$—e^1F_3	(0.20) 0.99	(0.24) 0.99
62.51	200	III E	441.69	a^3F_2—$z^3D^\circ_1$	(0.00 w) 0.89 A^2	(0.00) 0.91 A^2
55.49	400	V E	474.02	$z^3F^\circ_4$—e^3G_4	(0.43) 1.20 B	(0.37) 1.20
52.07	30 hl	I	489.81			
47.50	100	V E	510.94	$z^3F^\circ_4$—e^1F_3	(0.00, 0.31, 0.61) 1.98 A^2	(0.00, 0.30, 0.61) 2.17 A^2,
45.28	100	V E	521.22	a^3F_3—$z^3D^\circ_3$	(0.60) 1.26 B	(0.58) 1.20
41.40	2 h		539.21	e^1F_3—2°_4		
36.42	80	V E	562.35	$z^1D^\circ_2$—e^1D_2	(0.21) 1.00	(0.21) 0.99
34.95	25 l		569.19	$y^3D^\circ_3$—f^3D_2	(0.00) 1.43	(0.00) 1.48
23.99	2 h		620.31			
19.87	300	V E	639.59	$z^3F^\circ_2$—e^3F_2	(0.00) 0.70	(0.10) 0.70
13.38	200	V E	670.03	a^3P_1—$y^3D^\circ_2$	(0.00, 0.33) 0.83, 1.16, 1.49	(0.00, 0.32) 0.88, 1.19, 1.51
05.78	100	V E	705.79	a^3P_1—$z^1P^\circ_1$	(0.63) 0.89, 1.52	(0.62) 0.88, 1.51
01.65	3		725.27	e^3G_5—4°_4		
4,600.59	5 h		730.27	$y^3P^\circ_2$—f^3D_3 $y^3P^\circ_1$—f^3D_2		
4,595.06	2 h		756.42			
87.14	2 h		793.99	e^3F_3—2°_4		
80.05	150	V E	827.73	a^3P_1—$y^3P^\circ_0$	(0.00) 1.51	(0.00) 1.51
74.87	200	III E	852.44	a^1D_2—$z^3P^\circ_2$	(0.49, 0.98) 0.49, 0.98, 1.46, 1.94	(0.48, 0.95) 0.51, 0.99 1.46, 1.94
70.97	10	V E	871.08	a^3D_2—y^1D_2	(0.43) 1.00 R	(0.44) 1.02
62.5	5 h		911.7	e^3G_3—1°_3		
59.28	100	V E	927.16	a^3P_2—$y^3P^\circ_1$	(0.00, 0.18) 1.62	(0.00, 0.23) 1.26, 1.49, 1.71
58.46	200	III E	21,931.10	a^3D_2—$y^1F^\circ_3$	(0.00 w) 0.88 A^1	(0.00) 0.82 A^1
40.71	10		22,016.84	$z^1F^\circ_3$—e^3F_4	(0.00) 1.27	(0.00) 1.28
38.87	8 hl		025.76	$y^3P^\circ_2$—f^1D_2		
30.54	15	V E	066.26	b^1D_2—$x^3P^\circ_1$		
26.12	200	III E	087.81	a^3P_2—$y^3D^\circ_3$	(0.00 w) 1.01 A^1	(0.00) 0.96 A^1
25.31	100	V E	091.76	$z^3F^\circ_4$—e^3F_4	(0.46) 1.19 B	(0.39) 1.20
22.37	400	III E	106.12	b^1D_2—$x^1F^\circ_3$ a^3F_2—$z^3D^\circ_2$	(0.00) 1.02	(0.00) 1.00
16.38	5 hl		135.44			
08.48	10		174.22	a^3P_0—$z^1P^\circ_1$	(0.00) 0.90	(0.00) 0.88

TABLE 4.—*The first spark spectrum of lanthanum (La* II*)*—Continued

λ_{air} I. A.	Intensity spark	Temperature class	ν_{vac} cm^{-1}	Term combinations	Zeeman effects	
					Observed	Computed
05.82	3 hl		187.32	$y^3P^\circ_0$—f^3D_1		
4,502.16	10 hl		205.35	$x^3P^\circ_1$—e^3S_1	(0.00) 1.47	(0.00) 1.47
4,498.76	10		222.13	$y^3F^\circ_3$—e^1D_2	(0.00) 1.14	(0.00) 1.13
97.00	2		230.83	a^3F_3—$z^3P^\circ_2$		
84.48	1 h		292.90	e^1G_4—$6^\circ_{4,3}$		
81.21	25 hl		309.16	$z^1P^\circ_1$—f^3D_1	(0.40) 0.50, 0.87	(0.36) 0.52, 0.88
74.03	10		344.96	$y^3D^\circ_2$—f^3D_1	(0.00, 0.66) 0.50, 1.17, 1.83	(0.00, 0.67) 0.52, 1.19, 1.86
59.10	3		419.78	$z^1G^\circ_4$—e^3G_5		
55.79	50	V E	436.43	a^3P_1—$y^3P^\circ_1$	(0.24) 1.41	(0.24) 1.38
43.94	20 hl	I	496.26	$y^3D^\circ_2$—f^3D_2	(0.00) 1.18 h	(0.09) 1.17
35.84	10	IV E	537.34	$a^3F^\circ_2$—$z^3D^\circ_3$	(0.00, 0.60, 1.19) 1.28, 1.86, 2.44	(0.00, 0.59, 1.17) —, —, 1.32, 1.90, 2.49
32.95	20?		552.03	a^3F_4—$y^1F^\circ_3$		
29.90	400	III E	567.56	a^3D_1—$y^1D^\circ_2$	(0.00, 0.40) 0.51, 0.91, 1.31	(0.00, 0.38) 0.52, 0.90, 1.27
27.52	100	V E	579.69	$z^3F^\circ_3$—e^3F_3	(0.00 w) 1.06	(0.07) 1.07
19.16	30	V E	622.41	$z^1G^\circ_4$—e^1G_4	(0.28) 1.04	(0.21) 1.03
17.14	2 h	III	632.75	$x^3P^\circ_1$—e^1S_0		
12.22	2 h		657.98	e^3F_3—$3^\circ_{3,2}$		
11.21	25 hl	V E	663.17	$x^3F^\circ_4$—f^3D_3	(0.00 h) 1.13 h	(0.00) 1.12
4,403.02	2	III A	705.33	a^3F_2—$z^3P^\circ_1$		
4,385.20	40	V E	797.59	$z^3F^\circ_{33}$—e^3G_4	(0.00) 1.24	(0.00) 1.24
83.44	100	V E	806.75	$z^3F^\circ_2$—e^3F_3	(0.00, 0.40, 0.80) 0.28, 0.68, 1.08, 1.48, 1.88	(0.00, 0.38, 0.77) 0.29, 0.68, 1.06, 1.45, 1.83
78.10	50	IV E	834.56	$z^3F^\circ_3$—e^1F_3	(0.30 w) 0.95	(0.34) 1.02
64.66	100	IV E	904.88	a^3P_0—$y^3P^\circ_1$	(0.00) 1.28	(0.00) 1.26
63.05	50 l	V E	913.33	$y^3D^\circ_3$—f^3D_3	(0.00 h) 1.32 h	(0.03) 1.32
56.18	1		949.46	$y^1P^\circ_1$—e^1P_1		
54.40	200	IV E	22,958.84	a^1S_0—$y^1P^\circ_1$	(0.00) 1.08	(0.00) 1.07
37.78	10 l		23,046.81	$x^3F^\circ_3$—f^3D_2	(0.00) 1.08 h	(0.00) 1.02
34.96	100	V E	061.80	$z^3F^\circ_2$—e^1F_3	(0.00, 0.29, 0.57) 0.69, 0.97, 1.26, 1.54	(0.00, 0.28, 0.55)—0.68, 0.95, 1.23, 1.51
33.76	500	III E	068.19	a^1D_2—$y^1D^\circ_2$	(0.17) 0.94	(0.16) 0.94
22.51	100	III E	128.22	a^1D_2—$y^1F^\circ_3$	(0.00) 1.10	(0.00) 1.08
15.90	30	V E	163.65	a^3D_3—$x^3F^\circ_2$	(0.00, 0.50, 1.00) 0.86, 1.36, 1.86, 2.36	(0.00, 0.50, 1.00)—0.84, 1.34, 1.84, 2.34
04.11	10 hl		227.10	e^3F_4—$5^\circ_{4,3}$	(0.00 h) 1.24 h	
4,300.44	60	IV E	246.92	a^3F_2—$z^3P^\circ_2$	(0.73, 1.48) 0.00, 0.72, 1.45, 2.18	(0.73, 1.46) 0.00, 0.73, 1.46, 2.19
4,296.05	300	IV E	270.67	a^3P_2—$y^3P^\circ_2$	(0.00) 1.48	(0.02) 1.49
86.97	300	V E	319.96	$z^3F^\circ_4$—e^3G_5	(0.00) 1.08	(0.00) 1.09
75.64	100	IV E	381.75	a^3D_2—$y^3D^\circ_1$	(0.00, 0.35) 0.82, 1.17, 1.52	(0.00, 0.34) 0.80, 1.14, 1.48
69.50	300	V E	415.38	$z^3F^\circ_3$—e^3F_4	(0.00) 1.20	(0.00) 1.22
63.59	200	V E	447.83	$z^1F^\circ_3$—e^1G_4	(0.00) 1.12	(0.00) 1.08
59.51	2 h		470.30	$x^3F^\circ_2$—f^3D_2		
56.50	3		486.89			
52.93	4		506.61	a^3F_3—$y^1F^\circ_3$		
49.99	100	V E	522.87	$z^3F^\circ_4$—e^1G_4	(0.74) 0.50, 0.76, 1.02, 1.27, 1.53, 1.76	(—, —, 0.59, 0.79) 0.50, 0.75, 1.00, 1.25, 1.50, 1.75
48.32	2		532.11	$y^1P^\circ_1$—f^3F_2		
41.20	15 hl		571.62	e^3G_4—4°_4		
38.38	400	III E	587.30	a^3D_3—$x^3F^\circ_3$	(0.74) 0.56, 0.82, 1.08, 1.34, 1.60, 1.86	(—, 0.51, 0.77) 0.57, 0.83, 1.08, 1.34, 1.59, 1.85
30.95	150	V E	628.72	$z^1F^\circ_3$—e^3D_3	(0.80) 0.65, 0.85, 1.06, 1.26, 1.47, 1.67 ur	(—, 0.52, 0.78) 0.53, 0.79, 1.05, 1.31, 1.56, 1.82
17.56	200	V E	703.74	$z^3F^\circ_4$—e^3D_3	(0.00) 1.22	(0.00) 1.19
10.22	50 hl		745.06		(0.00 h) 1.02 h	
07.61	10 l		759.79	$y^3D^\circ_1$—f^3D_1	(0.27) 0.68 h	(0.28) 0.66
04.03	100	V E	780.02	a^3P_1—$y^3P^\circ_2$	(0.00) 1.48	(0.00) 1.49
4,201.50	6 h		794.34			
4,196.55	250	III E	822.41	a^3D_2—$x^3F^\circ_2$	(0.32, 0.64) 0.51, 0.82, 1.13, 1.44	(0.30, 0.61) 0.53, 0.84, 1.14, 1.44
94.36	30 h		834.85	$x^1F^\circ_3$—f^1G_4	(0.00 h) 1.06 h	(0.00) 1.06
93.34	5		840.64	[$y^3D^\circ_2$—f^3D_3]	(0.25) 0.64	(0.00) 1.47 (?)
92.35	100	V E	846.27	$z^3F^\circ_3$—e^3D_2	(0.00) 1.06	(0.00) 1.07

TABLE 4.—*The first spark spectrum of lanthanum (La* II*)*—Continued

λ_{air} I. A.	Intensity spark	Temperature class	ν_{vac} cm^{-1}	Term combinations	Zeeman effects	
					Observed	Computed
80.97	12 l		23,911.18	$y^3D_1^\circ$—f^3D_2		
61.94	8 h		24,020.51		(0.00 h) 1.02	
54.59	2 h		063.00	e^3F_3—$5^\circ_{4,3}$		
52.78	100	IV ? E	073.49	$z^3F_2^\circ$—e^3D_2	(0.43, 0.84) 0.27, 0.67, 1.08, 1.48	(0.42, 0.85) 0.25, 0.68, 1.10, 1.52
51.98	250	III E	078.13	a^3D_1—$y^3D_1^\circ$	(0.29) 0.50, 0.77	(0.28) 0.52, 0.80
48.2	4 h		100.1	$z^1P_1^\circ$—f^1D_2		
43.77	15		125.83	a^3P_2—$y^1P_1^\circ$		
41.73	200	IV E	137.72	a^3D_3—$y^3D_2^\circ$	(0.00 w) 1.50 w	(0.00) 1.48
37.91	2		160.00	e^3G_3—$3^\circ_{3,2}$		
33.33	6 hl		186.77		(0.00) 0.97	
32.50	10 hl		191.63	$y^3P_2^\circ$—g_3D_3	(0.00 h) 0.83 h	(0.00) 0.92
31.74	5 h		196.08	e^3D_3—$7^\circ_{4,3}$	(0.00 h) 1.13 h	
23.23	400	III E	246.01	a^3D_2—$x^3F_3^\circ$	(0.00) 1.05	(0.00) 1.02
15.35	1 h		292.44	$x^3F_4^\circ$—f^3G_3		
13.28	40 l		304.66	e^1F_3—$6^\circ_{4,3}$	(0.00 h) 1.09 h	
4,101.01	3 h		377.38	e^1G_4—$7^\circ_{4,3}$		
4,099.54	150	V E	386.12	$z_3F_2^\circ$—e^3D_1	(0.00) 0.77	(0.00) 0.77
98.73	5		390.94	$x^3F_3^\circ$—f^3D_3		
86.72	300	III E	462.62	a^3F_2—$y^1D_2^\circ$	(0.32) 0.79 w	(0.30) 0.81
77.35	300	III E	518.84	a^3D_1—$x^3F_2^\circ$	(0.00, 0.32) 0.57, 0.89, 1.20	(0.00, 0.32) 0.52, 0.84, 1.15
76.71	40	IV E	522.68	a^3F_2—$y^1F_3^\circ$	(0.00, 0.31, 0.62) 0.79, 1.08, 1.38, 1.69	(0.00, 0.30, 0.60) —, 0.73, 1.03, 1.33, 1.64
67.39	100	IV E	578.88	a^1D_2—$y^3D_1^\circ$	(0.00 w) 1.14 A^2	(0.00) 1.17 A^2
58.08	5 t		635.26	a^3P_1—$y^1P_1^\circ$	(0.45) 1.06, 1.47 us	(0.44) 1.07, 1.51
50.08	200	V E	683.92	$z^1F_3^\circ$—e^1D_2	(0.00) 1.02	(0.00) 1.05
42.91	300	IV E	727.70	a^1G_4—$x^1F_3^\circ$	(0.00) 0.99	(0.00) 1.00
36.59	15 d	V E	766.41	a^1S_0—$x^3P_1^\circ$	(0.00) 1.54	(0.00) 1.52
31.68	300	III E	796.57	a^3D_2—$y^3D_2^\circ$	(0.00) 1.15	(0.09) 1.17
25.87	50	IV E	832.36	a^3D_2—$z^1P_1^\circ$	(0.00 w) 1.37 A^2	(0.00) 1.40 A^2
23.58	40	IV E	846.49	$y^3F_3^\circ$—e^1G_4	(0.00) 1.07	(0.00) 1.02
20.19	2 h		867.44	$y^3P_2^\circ$—e^3S_1		
4,007.64	7 h		24,945.32		(0.00 w) 1.01 h	
3,995.74	400	III E	25,019.61	a^1D_2—$x^3F_2^\circ$	(0.30) 0.90 w	(0.27) 0.91
94.50	10		027.37	$z^3F_3^\circ$—e^3D_3	(0.57 h) 1.25 h	(0.56) 1.20
88.51	500	III E	064.96	a^3D_3—$y^3D_3^\circ$	(0.00) 1.32	(0.06) 1.32
81.36	10 l		109.97	$x^3F_2^\circ$—f^1D_2	(0.38) 0.98 h. us	(0.33) 0.93
79.08	8 l		124.35	$x^3F_4^\circ$—g^3D_3	(0.00) 1.26	(0.00) 1.30
63.04	5 l		226.04		(0.00 w) 0.82 h	
62.03	10 l		232.47		(0.00) 1.10 h	
58.53	2		254.78	$z^3F_2^\circ$—e^3D_3		
57.25	2		262.95			
56.07	4		270.48	$y^1D_2^\circ$—f^3D_1	(0.00 h) 1.29 h	(0.00) 1.27
55.21	3 h		275.98		(0.00) 1.15	
53.36	2		287.81		(0.00) 1.06	
51.43	3 h		300.16	$x^3F_3^\circ$—f^1F_3		
49.10	600	III E	315.09	a^3D_3—$x^3F_4^\circ$	(0.00) 1.13 w	(0.00) 1.11
44.15	3		346.86	$y^3D_2^\circ$—g^3D_2	(0.00) 1.18 h	(0.04) 1.18
39.85	20 l		374.52	$y^3D_3^\circ$—g^3D_3	(0.21) 1.27 h	(0.26) 1.26
36.22	50	IV E	397.92	a^3F_3—$x^3F_2^\circ$	(0.00, 0.25, 0.48), 0.86, 1.10, 1.34, 1.58.	(0.00, 0.26, 0.51) —, —, 0.84, 1.09, 1.35, 1.60
32.53	10 l		421.75	$y^1D_2^\circ$—f^3D_2	(0.44) 1.06 B	(0.44) 1.02
30.47	3		435.07		(0.00) 0.92	
29.22	300	III E	443.17	a^1D_2—$x^3F_3^\circ$	(0.00) 1.20	(0.00) 1.18
25.09	5		469.94	$y^3D_2^\circ$—f^3O_3		
24.69	3		472.53		(0.00 h) 0.72 h	
21.54	200	III E	492.99	a^3D_1—$y^3D_2^\circ$	(0.00, 0.66) 0.52, 1.18, 1.84	(0.00, 0.67) 0.52, 1.19, 1.86
16.05	300	III E	528.73	a^3D_1—$z^1P_0^\circ$	(0.38) 0.51, 0.88	(0.36) 0.52, 0.88
3,910.81	10 l	IV ? E	562.94	a^3D_2—$y^3P_1^\circ$	(0.00) 1.04	(0.00) 1.08
3,897.43	4		650.70	a^3D_1—$y^3P_0^\circ$		
92.47	3		683.37	$y^1P_1^\circ$—e^3P_2	(0.00 h) 1.4 h	(0.00) 1.30
92.05	3		686.15	$y^3P_2^\circ$—g^1D_2		
86.37	150	III E	723.69	a^3D_2—$y^3D_3^\circ$	(0.00 w) 1.62 A^2	(0.00) 1.66A^2

TABLE 4.—*The first spark spectrum of lanthanum* (*La II*)—Continued

λ_{air} I. A.	Intensity spark	Temperature class	ν_{vac} cm^{-1}	Term combinations	Zeeman effects	
					Observed	Computed
85.09	4		732.16	$y^3P^\circ_2-e^3P_1$		
71.64	200	III ? E	821.56	$a^3F_3-x^3F^\circ_3$	(0.00) 1.08	(0.00) 1.09
68.35	3 h		843.52			
64.49	100 l		869.33	$x^3F^\circ_4-f^3G_5$	(0.00 h) 1.10 h	(0.00) 1.11
63.11	2		878.57	$z^1P^\circ_1-e^1P_1$		
60.31	2		897.34	$x^3F^\circ_3-g^3D_2$		
54.91	30		933.62	$a^3P_2-x^3P^\circ_1$	(0.00) 1.50	(0.00) 1.48
49.02	100	III ?E	973.30	$a^3F_2-y^3D^\circ_1$	(0.00) 0.69	(0.00) 0.70
46.00	20	V ? E	25,993.69	$a^1D_2-y^3D^\circ_2$	(0.36) 1.11 B	(0.37) 1.09
40.72	60	V ? E	26,029.43	$a^1D_2-z^1P^\circ_1$	(0.00) 1.04	(0.00) 1.04
36.4	1		058.7	$x^1F^\circ_3-g^3F_4$		
35.09	50	V E	067.64	$a^3P_1-x^3P^\circ_0$	(0.00) 1.49.	(0.00) 1.51.
17.24	8 h		189.53	$e^3D_2-8^\circ_3$	(0.00) 0.82 h.	
16.25	10 h		196.33	$y^3D^\circ_1-g^3D_1$	(0.00 h) 0.68.	(0.13) 0.73.
14.1	2		211.1	$y^3P^\circ_1-e^3S_1$		
08.79	15		247.63	$a^3D_3-y^3P^\circ_2$	(0.00 w) 1.18 h	(0.00) 1.18
07.1	1		259.3	$a^3D_1-y^3P^\circ_1$		
04.8	2 h		275.2	$x^3F^\circ_4-f^3F_3$		
3,801.0	1		301.4	$y^3D^\circ_2-g^3D_3$		
3,798.19	2		320.88	$x^3F^\circ_2-g^3D_2$		
94.78	400	III E	344.54	$a^3F_4-y^3D^\circ_3$	(0.00) 1.16	(0.00) 1.18.
90.83	300	III E	371.99	$a^3F_3-y^3D^\circ_2$	(0.00) 1.00.	(0.00) 0.99.
84.81	15	V E	413.93	$a^3F_2-x^3F^\circ_2$	(0.17) 0.79.	(0.19) 0.78.
83.06	1		426.15	$e^3G_4-7^\circ_{4,3}$		
80.67	50?	V E	442.85	$a^3P_1-x^3P^\circ_1$	(0.00) 1.54.	(0.01) 1.51.
80.53	50?		443.84	$x^3F^\circ_2-f^3G_3$	(0.00 h) 0.92 h.	(0.00) 0.94.
73.12	150 l		495.77	$x^3F^\circ_3-f^3G_4$	(0.00) 1.00 h.	(0.00) 1.00.
68.98	3 h		524.87	$y^3D^\circ_3-f^3F_3$		
67.05	5 h		538.46	$y^3P^\circ_2-e^3P_2$	(0.47) 1.24 B.	(0.50) 1.36.
66.58	3 h		541.77	$x^3F^\circ_4-e^3H_4$		
59.08	300	III E	594.72	$a^3F_4-x^3F^\circ_4$	(0.00) 1.25.	(0.04) 1.25.
53.04	2 h		637.52	$z^3P^\circ_2-f^3D_2$		
47.96	5 l		673.63		(0.00 w) 0.90 h.	
44.85	2 h		695.78			
36.41	15 l		756.08	$x^3F^\circ_4-f^3F_4$	(0.37) 1.20 B.	(0.29) 1.20.
35.85	10	IV E	760.09	$a^1D_2-y^3P^\circ_1$	(0.00 w) 0.90 d	(0.00) 0.85
35.09	1		765.53	$y^1D^\circ_2-f^3D_3$		
31.42	8 h		791.86	$y^3D^\circ_3-e^3H_4$		
28.97	2 h		809.46	$y^3P^\circ_1-e^3P_0$		
25.05	20	IV E	837.67	$a^3F_2-x^3F^\circ_3$	(0.00, 038, 0.75) 0.79, 1.16, 1.53, 1.90	(0.00, 0.35, 0.70)—, 0.73, 1.08, 1.43, 1.78
20.75	2		868.69	$y^3D^\circ_3-g^1D_2$		
17.99	2		888.63	$x^3F^\circ_2-e^1P_1$		
15.53	50	IV E	906.44	$a^3D_2-y^3P^\circ_2$	(0.40, 0.72) 0.80, 1.13, 1.46, 1.79	(0.36, 0.71) 0.78, 1.14, 1.50, 1.85
14.87	40	V E	911.22	$a^3P_0-x^3P^\circ_1$	(0.00) 1.50	(0.00) 1.52
13.54	100	IV E	920.85	$a^1D_2-y^3D^\circ_3$	(0.00, 0.34, 0.68) 1.00, 1.35, 1.69, 2.03	(0.00, 0.32, 0.65)—, 0.99, 1.31, 1.64, 1.96
10.61	2		942.11	$z^1P^\circ_1-e^3S_1$		
05.81	80	V E	26,977.01	$a^3P_2-x^3P^\circ_2$	(0.00) 1.51	(0.02) 1.48
3,701.81	40 l	V E	27,006.15	$y^3D^\circ_3-f^3F_4$	(0.00 w) 0.73 A[1]	(0.00) 0.70 A[1]
3,696.11	2 h		047.80	$x^3F^\circ_3-f^3F_2$		
95.2	2 h		054.5			
94.27	7 h		061.27	$y^1D^\circ_2-f^1D_2$	(0.36) 0.88 h	(0.22) 0.96
92.31	2 h		075.64	$y^3P^\circ_1-e^3P_1$		
78.24	2 h		179.20	$z^3P^\circ_1-f^3D_2$		
75.22	1		201.54	$e^1F^3-8^\circ_3$		
70.23	4 h		238.52	$e^3G^4-8^\circ_3$	(0.30) 1.06	
69.27	3 h		245.65			
65.22	10 l		275.75	$x^3F^\circ_2-g^3D_3$?	(0.00 d) 1.92 d	(0.00, 0.37, —)—, —, 1.51, 1.96.
62.08	30	IV E	299.14	$a^3F_3-y^3D^\circ_3$	(0.66) 1.16 B	(0.57) 1.20
58.40	3		326.60	$x^1F^\circ_3-g^1G_4$	(0.00) 1.0	(0.00) 1.17
58.04	1		329.29	$y^3D^\circ_1-e^1P_1$		

TABLE 4.—*The first spark spectrum of lanthanum (La II)*—Continued

λ_{air} I. A.	Intensity spark	Temperature class	ν_{vac} cm^{-1}	Term combinations	Zeeman effects	
					Observed	Computed
56.62	1 h		369.84	$z^1P_1^\circ—e^1S_0$		
50.19	80	V E	388.06	$a^3F_2—y^3D_2^\circ$	(0.48, 0.91) 0.29, 0.73, 1.18, 1.62	(0.46, 0.92) 0.27, 0.73, 1.19, 1.65
45.43	200	IV E	423.82	$a^3F_2—z^1P_1^\circ$	(0.00) 0.66	(0.00) 0.65
41.66	50 l		452.21	$y^3D_2^\circ—f^3F_3$	(0.00) 1.21	(0.00) 1.09
41.10	2		456.43	$z^1H_5^\circ—e^3H_5$	(0.00) 1.01	(0.00) 1.02
39.25	3 h		470.39	$x^3F_4^\circ—f^1G_4$		
37.15	40	V E	486.25	$a^3P_1—x^3P_2^\circ$	(0.00) 1.51	(0.00) 1.46
29.99	2 hl		540.46	$z^1P_1^\circ—e^3P_0$		
28.83	60	IV E	549.27	$a^3F_3—x^3F_4^\circ$	(0.00 w) 1.68 A²	(0.00) 1.71 A²
21.77	4	V E	602.97	$a^3D_1—y^3P_2^\circ$		
20.16	1		615.24	$y^1F_3^\circ—f^1F_3$		
18.60	1		627.15	$z^3D_2^\circ—f^3D_1$		
12.34	50	V E	675.02	$y^1D_2^\circ—f^1F_3$	(0.00) 1.11	(0.00) 1.10
11.09	2		684.60	$y^3P_0^\circ—e^3P_1$	(0.00) 1.57 h	(0.00) 1.57
10.25	30 l		691.04		(0.00) 1.02	(0.00) 1.03
09.22	4		698.95	$x^1F_3^\circ—h^1D_2$	(0.00) 1.00	(0.00) 1.01
08.18	4		706.93	$y^1D_2^\circ—g^3D_1$	(0.00w) 1.08 A²	(0.00) 1.12 A²
06.42	4 hl		720.45	$y^3D_3^\circ—f^1G_4$		
3,601.07	20 hl	*v* E	761.63	$a^3D_2—y^1P_1^\circ$	(0.00) 1.18	(0.00) 1.17
3,598.93	3 hl		778.14	$z^3D_2^\circ—f^3D_2$	(0.00) 1.15	(0.08) 1.16
96.65	4 hl		795.75	$y^3D_2^\circ—g^1D_2$	(0.00) 1.22	(0.20) 1.14
93.29		*v* E	821.74			
92.42	2 h		828.48			
90.66	1 h		842.11	$y^3D_2^\circ—e^3P_1$		
85.53	2		881.95	$y^3P_1^\circ—e^3P_2$	(0.00) 1.25	(0.00) 1.20
81.68	20 hl		911.92	$y^3D_1^\circ—f^3F_2$	(0.00) 0.74	(0.00) 0.76
80.10	8 h		924.24	$x^3P_2^\circ—f^3P_1$	(0.00) 1.52	(0.00) 1.48
78.89	5 h		933.68	$x^3P_1^\circ—f^3P_0$	(0.00) 1.44	(0.00) 1.52
76.56	2 hl		27,951.88	$x^3F_2^\circ—e^3S_1$		
70.10	30 hl		28,002.38	$x^3F_3^\circ—f^3F_3$	(0.00) 1.08	(0.15) 1.11
57.26	8	IV ? E	103.53	$a^1D_2—y^3P_2^\circ$		
50.82	6	IV ? E	154.49	$a^3F_2—y^3P_1^\circ$		
36.37	3 h		269.53	$x^3F_3^\circ—e^3H_4$		
33.67	3 h		291.13	$z^3D_1^\circ—f^3D_1$		
30.67	8	V ? E	315.17	$a^3F_2—y^3D_3^\circ$		
26.77	2 h		346.48	$x^3F_3^\circ—g^1D_2$		
20.72	10 hl		395.19	$y^1D_2^\circ—f^3G_3$	(0.00) 0.88	(0.00) 0.88
14.87	2 h		442.45	$z^3D_1^\circ—f^3D_2$		
12.93	10	IV E	458.15	$a^3D_1—y^1P_1^\circ$	(0.53) 0.53, 1.10	(0.55) 0.52, 1.07
10.00	15	IV E	481.91	$a^3F_3—y^3P_2^\circ$		
3,507.90	4 hl		498.96			
3,493.97	2 h		612.58	$z^1P_1^\circ—e^3P_2$		
84.39	10 l		691.25	$z^3O_3^\circ—f^3D_3$	(0.00) 1.33	(0.04) 1.32
74.84	8 l		770.10	$x^3F_2^\circ—g^1D_2$		
66.46	1 h		839.64	$y^1D_2^\circ—e^1P_1$		
62.32	2 h		874.13			
60.31	5 l		890.90	$z^3P_2^\circ—f^1F_3$		
53.17	50	III E	950.63	$a^3D_3—x^1F_3^\circ$	(0.93) 0.37, 0.68, 1.00, 1.31, 1.63, 1.94	(–, –, 0.99) 0.34, 0.68, 1.01, 1.34, 1.67, 2.00
52.18	40	III E	958.94	$a^1D_2—y^1P_1^\circ$	(0.00) 0.95	(0.00) 0.95
51.12	3 l		28,967.83	$x^3P_1^\circ—f^3P_1$		
32.81	5		29,122.34	$z^3D_2^\circ—f^3D_3$		
27.57	8		166.85	$y^1F_3^\circ—g^3D_3$		
23.9	5		198.1	$x^3F_3^\circ—f^1G_4$		
22.44	2		210.57	$y^3D_1^\circ—g^1D_2$		
20.54	5 h		226.80	$y^1D_2^\circ—g^3D_3$		
11.76	20 hl		302.01	$x^3P_2^\circ—f^3P_2$	(0.00 w) 1.48	(0.05) 1.46
3,407.00	8 hl		342.95	$x^3P_0^\circ—f^3P_1$	(0.00) 1.50	(0.00) 1.47
3,398.29	2 h		418.15	$z^3D_2^\circ—f^1D_2$		
97.77	40 hl	V E	422.65	$y^1D_2^\circ—f^3F_2$	(0.24) 0.85	(0.23) 0.83
92.94	4 b		464.54	$z^3P_1^\circ—g^3D_1$		
90.40	4 h		486.61	$\left\{\begin{array}{l} z^3P_0^\circ—g^3D_1 \\ z^3P_2^\circ—g^3D_2 \end{array}\right.$		
80.91	300	III E	569.36	$a^3D_2—x^3P_1^\circ$	(0.00, 0.37) 0.75, 1.11, 1.47	(0.00, 0.38) 0.76, 1.14, 1.52
76.33	50	III E	609.49	$a^3D_2—x^1F_3^\circ$	(0.00) 0.88	(0.00) 0.87

TABLE 4.—*The first spark spectrum of lanthanum (La II)*—Continued

λ_{air} I. A.	Intensity spark	Temperature class	ν_{vac} cm^{-1}	Term combinations	Zeeman effects	
					Observed	Computed
74.89	3		622.12			
51.89	3		825.37	$z^1F^\circ_3$—i^1D_2		
44.56	200	III E	890.73	a^3D_1—$x^3P^\circ_0$	(0.00) 0.53	(0.00) 0.52
37.49	300	III E	29,954.05	a^3D_3—$x^3P^\circ_2$	(0.00 w) 1.12 A[1]	(0.00) 1.06 A[1]
29.07	8		30,029.81	$z^3P^\circ_1$—g^3D_2		
26.21	5		055.63	$z^3P^\circ_2$—e^1P_1		
25.33	3		063.59	$z^3D^\circ_2$—g^3D_1		
10.62	4		197.16	$z^3D^\circ_3$—g^3D_2		
06.98	8	IV E	230.40	a^3F_4—$x^1F^\circ_3$	(0.00) 1.77 R	(0.00) 1.03
3,303.11	150	III E	265.82	a^3D_1—$x^3P^\circ_1$	(1.00) 0.51, 1.51	(1.00) 0.52, 1.52
3,298.72	5 h		306.09			
97.15	3		320.52	z^3D_3—f^3G_3		
94.44	10		345.46	$x^3P^\circ_1$—f^3P_2		
83.95	8 h		442.39	$z^3P^\circ_2$—g^3D_3		
77.83	4		499.23	$x^3P^\circ_2$—g^3P_1		
67.31	3		597.43	$z^3P^\circ_1$—e^1P_1		
65.67	600	III E	612.79	a^3D_2—$x^3P^\circ_2$	(0.48, 0.80) 0.82, 1.17, 1.51, 1.86	(0.34, 0.68) 0.80. 1.14, 1.48, 1.82
63.98	5		628.64	$z^3D^\circ_2$—g^3D_2		
53.41	10 h		728.15	$z^3D^\circ_1$—g^3D_1	(0.00) 0.65	(0.12) 0.61
49.35	80	III E	766.54	a^1D_2—$x^3P^\circ_1$	(0.00, 0.50) 0.46, 0.94, 1.44	(0.00, 0.53) 0.46, 0.99, 1.52
45.13	150	III E	806.55	a^1D_2—$x^1F^\circ_3$	(0.00) 1.04	(0.00) 1.03
26.03	2		30,988.93	$z^1D^\circ_2$—f^3D_2		
24.71	1		31,001.62	$z^1H^\circ_5$—g^1G_4		
17.12	8 h		074.76	$x^3P^\circ_2$—g^3P_2		
12.56	5		118.86	$z^3P^\circ_2$—e^3S_1		
09.13	6		152.12	$z^3D^\circ_3$—g^3D_3		
08.13	6		161.83			
05.75	4		184.96	a^3F_3—$x^1F^\circ_3$		
3,204.55	3		196.64	$z^3D^\circ_2$—e^1P_1		
3,194.70	2		292.83	$z^3D^\circ_1$—g^3D_2		
93.02	25	IV E	309.29	a^3D_1—$x^3P^\circ_2$	(0.00, 0.96) 0.61, 1.58, 2.54.	(0.00, 0.96) 0.52, 1.48, 2.44
91.39	10 h		325.28	$x^3P^\circ_2$—h^3D_2		
74.88	10 hl		488.18	$x^3P^\circ_2$—h^3D_3		
66.26	2		573.90	$y^1D^\circ_2$—e^3P_2		
65.19	4		584.57	$y^3D^\circ_3$—h^1D_2		
60.56	3		630.84	$y^3P^\circ_2$—f^3P_1		
57.58	2		660.69	$z^3P^\circ_1$—e^3S_1		
56.35	2		673.02	$y^1P^\circ_1$—i^1D_2		
45.7	2 h		780.3	$z^3D^\circ_2$—f^3F_2		
42.76	40	IV E	809.98	a^1D_2—$x^3P^\circ_2$		
32.14	3		917.83	$x^3P^\circ_0$—g^3P_1		
30.25	2		937.10	$z^3P^\circ_2$—g^1D_2		
25.72	4 hl		31,983.39	$z^3P^\circ_2$—e^3P_1		
12.63	8 h		32,117.88	$x^3P^\circ_1$—g^3P_2		
08.46	8	IV E	160.97	a^3F_2—$x^3P^\circ_1$		
3,104.58	50	IV E	201.16	a^3F_2—$x^1F^\circ_3$	(0.00 w) 1.50 A[2]	(0.00) 1.56 A[2]
3,094.76	4 h		303.34			
88.53	4 h		368.49	$x^3P^\circ_1$—h^3D_2		
81.42	6 h		443.18	$z^3D^\circ_1$—f^3F_2		
75.51	4 h		505.52	$z^1F^\circ_3$— $^1D_2$?		
69.45	3		569.69	$z^3D^\circ_3$—e^3H_4		
68.96	4		575.09	$x^3P^\circ_0$—h^3D_1		
59.91	8		671.23	$z^1P^\circ_1$—f^3P_0		
54.02	6		734.24	$z^3D^\circ_2$—f^3F_3		
49.39	5		783.94	$z^3D^\circ_3$—f^3F_4		
45.63	1		824.41	$z^3G^\circ_5$—e^3H_4		
36.43	2		923.86	$z^3D^\circ_1$—e^3S_1		
35.80	1		32,930.69	$z^3G^\circ_3$—f^3G_4		
28.64	2		33,008.54	$y^3P^\circ_2$—f^3P_2		
25.88	4 ?		038.65	$z^3G^\circ_5$—f^3F_4		
22.26	5 hl		078.22	$z^3D^\circ_2$—g^1D_2		
18.95	6 hl		114.48			

TABLE 4.—*The first spark spectrum of lanthanum (La II)*—Continued

λ_{air} I. A.	Intensity spark	Temperature class	ν_{vac} cm^{-1}	Term combinations	Zeeman effects	
					Observed	Computed
07.32	5		242.54	$z^1D_2^\circ-f^1F_3$		
3,004.68	5 h		271.74			
2,985.76	2		482.57	$z^3G_3^\circ-f^3F_2$		
85.43	5		486.27	$x^3F_2^\circ-h^1D_2$		
84.33	3		498.61	$z^3D_3^\circ-f^1G_4$		
83.44	3		508.61	$z^3G_4^\circ-f^3F_3$		
76.83	3		583.01	$y^3P_0^\circ-f^3P_1$		
71.48	1		643.47	$y^3F_4^\circ-f^3G_3$		
66.55	4		699.38	$z^3G_5^\circ-e^3H_5$		
66.08	2		704.72	$z^1P_1^\circ-f^3P_1$		
62.90	15		740.89	$y^3O_2^\circ-f^3P_1$		
59.85	5		775.65	$z^3G_4^\circ-e^3H_4$		
58.71	1		788.67	$z^3D_1^\circ-e^3P_1$		
51.46	3		871.66	$y^3P_1^\circ-i^1D_2$		
50.50	50	V E	882.68	$z^1H_5^\circ-e^1I_6$	(0.00) 1.04	(0.00) 1.04
48.82	1		901.99	$y^3F_3^\circ-f^1F_3$		
43.56	6 hl		33,962.57	$z^1D_2^\circ-f^3G_3$		
39.64	3 h		34,007.85	$y^1P_1^\circ-h^3D_1$		
29.86	7		121.37	$y^3D_1^\circ-f^3P_0$		
25.15	5 h		176.31	$y^1P_1^\circ-h^3D_2$		
23.90	20		190.92	$y^3D_3^\circ-f^3P_2$	(0.00) 1.23?	(0.00) 1.17
13.60	2		311.78	$y^3F_2^\circ-f^1D_2$		
10.05	1		353.63	$y^1P_1^\circ-{}^1D_2$?		
2,905.53	4 hl		407.07	$z^1D_2^\circ-e^1P_1$		
2,899.80	4 hl		475.06	$y^3F_4^\circ-g^3D_3$		
97.76	5 hl		499.32	$y^3F_3^\circ-g^3D_2$		
93.08	60	V E	555.14	$z^3G_5^\circ-e^3H_6$	(0.00) 1.12	(0.00) 1.12
89.11	1		602.61	$z^1P_1^\circ-i^1D_2$		
85.13	50	V E	650.35	$z^3G_4^\circ-e^3H_5$	(0.00) 1.04	(0.00) 1.00
83.35	1		671.74	$z^3P_2^\circ-g^3F_3$		
80.65	40	V E	704.23	$z^3G_3^\circ-e^3H_4$	(0.00) 1.18	(0.00) 1.19
76.55	1		753.69			
74.28	3		781.14	$z^3G_3^\circ-g^1D_2$		
73.20	2		794.21	$z^1D_2^\circ-g^3D_3$		
67.47	2 h		863.74	$y^3P_2^\circ-h^3D_1$		
62.98	15 hl	V E	918.41	$z^3G_3^\circ-f^3F_4$		
62.37	6		925.85	$y^3F_2-f^1F_3$		
59.76	5		34,957.73	$y^3F_2^\circ-g^3D_1$		
55.90	50 hl	V E	35,004.97	$y^1F_3^\circ-g^1G_4$	(0.00) 1.13	(0.00) 1.13
53.72	4 h		031.71	$y^3P_2^\circ-h^3D_2$		
49.51	2 h		083.47			
48.34	6		097.88	$y^3F_3^\circ-f_3G_4$		
46.67	5		118.47	$y^3D_2^\circ-f^3P_2$		
43.67	4		155.51	$y^3D_1^\circ-f^3P_1$		
40.51	25 hl		194.62	$y^3P_2^\circ-h^3D_3$		
38.45	5 l		220.16	$y^3F_4^\circ-f^3G_5$		
32.53	5		293.77	$z^3D_2^\circ-g^3F_2$		
25.82	1		377.57	$y^1F_3^\circ-h^1D_2$		
25.51	5		381.45	$z^3D_3^\circ-g^3F_3$		
21.03	5		437.64	$y^1D_2^\circ-h^1D_2$		
19.73	2		453.97	$y^3F_3^\circ-g^3D_3$		
18.40	3		470.70	$z^1D_2^\circ-e^3S_1$		
15.36	6		509.00	$z^3F_3^\circ-f^3D_2$		
13.72	5		529.70	$z^3F_4^\circ-f^3D_3$		
13.05	3		538.16	$z^1G_4^\circ-f^1F_3$		
09.35	2		584.96	$z^3F_2^\circ-f^3D_1$		
08.39	150	V E	597.13	$b^1D_2-x^1P_1^\circ$	(0.00) 1.04	(0.00) 1.04
07.20	1		612.22	$x^3F_2^\circ-i^1D_2$		
05.58	5		632.78	$z^3G_3^\circ-f^1G_4$		
2,804.55	4		645.86	$y^3F_2^\circ-f^3G_3$		
2,798.56	40 hl	V E	722.15	$z^3D_3^\circ-g^3F_4$	(0.00) 1.08	(0.00) 1.08
96.40	5		749.75	$z^1F_3^\circ-f^1D_2$		
91.51	25		812.37	$z^3D_2^\circ-g^3F_3$	(0.00) 1.04 R	(0.00) 1.03
81.25	1		944.47	$z^1D_2^\circ-f^3F_3$		
80.23	20		957.66	$z^3D_1^\circ-g^3F_2$		

TABLE 4.—*The first spark spectrum of lanthanum (La II)*—Continued

λ_{air} I. A.	Intensity spark	Temperature class	ν_{vac} cm^{-1}	Term combinations	Zeeman effects	
					Observed	Computed
79.78	10		963.48	$y^3D^\circ_3$—g^3P_2		
78.76	10		35,976.68	$z^3G^\circ_5$—g^3F_4		
73.86	1		36,040.23	$z^1P^\circ_1$—g^3P_0		
67.40	8		124.35	$y^3P^\circ_1$—g^3P_2		
61.10	5		206.77	$y^3P^\circ_1$—h^3D_1		
60.51	3		214.51	$y^3D^\circ_3$—h^3D_2		
59.14	3		232.49	$z^3H^\circ_6$—e^3H_5		
58.65	3		238.93	$y^1P^\circ_1$—f^1S_0		
55.57	1		279.43	$z^1P^\circ_1$—g^3P_1		
52.84	10		315.41	$y^3D^\circ_2$—g^3P_1		
48.31	8		375.26	$y^3P^\circ_1$—h^3D_2		
36.90	2		526.90	$z^3H^\circ_5$—e^3H_4		
36.41	3		533.44	$y^3D^\circ_1$—f^3P_2		
32.40	10		587.05	$z^3G^\circ_4$—g^3F_3		
27.5	2		652 8	$z^3P^\circ_2$—h^1D_2		
26.48	1		666.49	$y^1D^\circ_2$—f^3P_1		
21.45	2		734.25	$z^1G^\circ_4$—f^3G_4		
15.43	10 hl		815.68	$y^3P^\circ_0$—h^3D_1		
12.51	1		855.32	$z^1P^\circ_1$—g^3P_2		
09.92	3		890.54	$y^3D^\circ_2$—g^3P_2		
06.49	2		937.29	$z^1P^\circ_1$—h^3D_1		
2,702.13	8		36,996.88	$z^3G^\circ_3$—g^3F_2		
2,695.47	35		37,088.29	$z^3H^\circ_6$—e^3H_6		
94.21	5		105.64	$z^1P^\circ_1$—h^3D_2		
91.60	1		141.62	$y^3D^\circ_2$—h^3D_2		
87.75	2		194.81	$z^3P^\circ_1$—h^1D_2		
81.49	10		281.64	$z^3H^\circ_4$—e^3H_4		
79.87	4 h		304.17	$y^3D^\circ_2$—h^3D_3		
75.66	5		362.87	$z^3D^\circ_3$—h^1D_2		
73.74	3		389.70	$z^3P^\circ_1$—f^3P_0		
72.90	30		401.45	$z^3H^\circ_5$—e^3H_5		
72.06	2		413.20			
70.05	2		441.37	$x^3F^\circ_3$—g^3P_2		
66.54	3		490.65	$y^3D^\circ_1$—g^3P_0		
66.18	6		495.71	$z^3H^\circ_4$—f^3F_4		
65.62	4		503.59	$y^1F^\circ_3$—i^1D_2		
64.75	3		515.83	$z^3G^\circ_3$—g^3F_3		
62.73	1 h		544.29			
61.66	3		559.38	$z^1F^\circ_3$—f^3G_4		
61.36	4		563.61	$y^1D^\circ_2$—i^1D_2		
49.61	1		730.18	$y^3D^\circ_1$—g^3P_1		
47.36	4		762.25	$z^3F^\circ_3$—f^1F_3		
44.70	1		800.23	$y^3F^\circ_3$—f^1G_4		
42.27	1		834.96	$z^1G^\circ_4$—f^3G_5		
40.15	1		865.37	$x^3F^\circ_2$—g^3P_2		
39.00	5		881.87	$z^3P^\circ_2$—f^2P_1		
36.66	1		915.48	$z^1F^\circ_3$—g^3D_3		
31.94	8		983.47	$y^1F^\circ_3$—f^3P_2		
31.52	4		3,7989.54	$z^3F^\circ_2$—f^1F_3		
20.01	7		3,8156.42	$z^3H^\circ_4$—e^3H_5		
17.29	1		196.07	$z^3G^\circ_4$—g^1G_4		
16.32	7 hl		210.23	$z^3H^\circ_4$—f^1G_4		
13.09	4		257.46	z^3H_5—e^3H_6		
10.34	150		297.76	a^1S_0—$x^1P^\circ_1$		
04.18	1		388.35	$y^3D^\circ_1$—h^3D_1		
02.87	1		407.66			
01.79	5		423.60	$z^3P^\circ_1$—f^3P_1		
00.86	2		437.34	$y^3P^\circ_1$—f^1S_0		
2,600.33	4		445.18	$z^3P^\circ_0$—f^3P_1		
2,596.32	3		504.55	$z^1D^\circ_2$—g^3F_2		
96.08	20		508.11	$z^1G^\circ_4$—e^3H_4		
92.87	3 h		555.78	$y^3D^\circ_1$—h^3D_2		
86.35	10		652.97	$z^3D^\circ_1$—f^3P_0		
82.96	8		703.70	$y^3F^\circ_4$—g^3F_3		
82.55	6		709.85	$z^3F^\circ_2$—f^3G_3		

TABLE 4.—*The first spark spectrum of lanthanum (La II)*—Continued

λ_{air} I. A.	Intensity spark	Temperature class	ν_{vac} cm^{-1}	Term combinations	Zeeman effects	
					Observed	Computed
80.82	8 hl		735.79	$z^3F^\circ_4$—f^3G_5		
77.92	2		779.36	$z^3P^\circ_2$—i^1D_2		
73.47	2 h		846.42			
66.09	10 hl		38,958.13	$z^3F^\circ_3$—f^3G_4		
61.84	20 l		39,022.75	$z^1D^\circ_2$—g^3F_3 $z^3D^\circ_2$—f^3P_1		
60.37	50		045.15	$y^3F^\circ_4$—g^3F_4		
58.99	3		066.21	$z^1F^\circ_3$—f^3F_3		
58.72	2		070.33			
53.41	3 h		151.57	$y^1P^\circ_1$—g^1S_0		
52.60	7		164.00	$y^3F^\circ_3$—g^3F_2		
52.36	2		167.68	$z^1P^\circ_1$—f^1S_0		
46.40	20 hl		259.35	$z^3P^\circ_2$—f^3P_2		
42.40	6		321.11	$z^3P^\circ_2$—i^1D_2		
41.60	4		333.49	$z^1F^\circ_3$—e^3H_4		
38.40	2		383.07	$z^1G^\circ_4$—e^3H_5		
36.76	3		408.53	$z^3F^\circ_4$—e^3H_4		
34.98	6		436.21	$z^1G^\circ_4$—f^1G_4		
33.14	15		464.84	a^3P_2—$x^1P^\circ_1$		
31.60	8		488.84	$z^3D^\circ_3$—i^1D_2		
30.26	1		509.76	$z^3F^\circ_3$—f^3F_2		
27.84	3		547.58	$z^1F^\circ_3$—f^3F_4		
23.07	5 hl		622.34	$z^3F^\circ_4$—f^3F_4		
19.22	50		682.89	$y^3F^\circ_3$—g^3F_3		
15.79	4		736.99	$z^3F^\circ_2$—f^3F_2		
14.59	3		755.95	$y^1F^\circ_3$—g^3P_2		
2,501.18	15 hl		969.08	$z^3D^\circ_3$—f^3P_2		
2,499.69	1		39,992.91			
95.82	2		40,054.91			
94.90	1		069.68			
87.59	40		187.42	$y^3F^\circ_2$—g^3F_2		
83.00	2hl		261.71	$z^1F^\circ_3$—f^1G_4		
79.85	10 l		312.85	$y^3F^\circ_4$—g^1G_4		
74.50	3		400.00	$z^3D^\circ_2$—f^3P_2		
72.44	10		433.65	$z^3H^\circ_4$—g^3F_4		
71.90	20		442.49	a^3P_0—$x^1P^\circ_1$		
71.06	5		456.23	$z^3P^\circ_2$—g^3P_1		
70.55	3		464.58	$z^3F^\circ_3$—f^3F_3		
68.11	1		504.58			
58.15	2		668.69	$x^3F^\circ_4$—i^3D_3		
55.88	10		706.28	$y^3F^\circ_2$—g^3F_3		
54.30	1		732.48	$z^3F^\circ_3$—e^3H_4		
52.73	8		758.55	$z^3P^\circ_1$—g^3P_0		
51.59	2		777.50			
45.56	10 h		878.04			
43.14	2 h		918.53	$y^3D^\circ_3$—i^3D_3		
42.80	3		924.22			
39.08	2		986.63			
38.42	10		40,997.82	$z^3P^\circ_1$—g^3P_1		
38.02	20		41,004.45	$z^1D^\circ_2$—h^1D_2		
37.14	10		019.26	$z^3P^\circ_0$—g^3P_1		
36.42	15		031.37	$z^3P^\circ_2$—g^3P_2		
31.40	6 h		116.08			
24.53	2 h		232.58			
21.61	5 h		282.29	$z^3P^\circ_2$—h^3D_2		
20.01	5 hl		309.58			
17.61	3 h		350.59	$y^3P^\circ_1$—g^1S_0		
12.08	2 h		445.38	$z^3P^\circ_2$—h^3D_3		
10.10	5 hl		479.43			
07.79	5 hl		519.22			
04.65	6		573.43	$z^3P^\circ_1$—g^3P_2		
03.29	7		596.96	$z^3D^\circ_2$—g^3P_1		
2,401.46	2 h		628.66			
2,399.64	20 hl		660.22	$z^1G^\circ_4$—g^3F_4		
98.70	3 h		676.55			
97.26	7 hl		701.57	$z^3H^\circ_4$—g^1G_4		

TABLE 4.—*The first spark spectrum of lanthanum (La II)*—Continued

λ_{air} I. A.	Intensity spark	Temperature class	ν_{vac} cm^{-1}	Term combinations	Zeeman effects	
					Observed	Computed
94.98	4		741.27	$z^3\mathrm{D}^\circ_3$—$g^3\mathrm{P}_2$		
93.27	2 h		771.10			
89.84	3 hl		831.04			
88.96	2		846.45			
86.26	2		893.80			
84.28	3 h		41,928.58			
75.63	2 h		42,081.24	$z^1\mathrm{P}^\circ_1$—$g^1\mathrm{S}_0$		
70.47	2		172.84	$z^3\mathrm{D}^\circ_2$—$g^3\mathrm{P}_2$		
69.18	2		195.79			
65.50	3		261.43	$z^3\mathrm{D}^\circ_1$—$g^3\mathrm{P}_1$		
58.02	3 h		395.48			
56.10	1 h		430.02			
55.81	5 h		435.24			
53.40	2		478.70			
53.03	1		485.48	$z^1\mathrm{F}^\circ_3$—$g^3\mathrm{F}_4$		
51.93	1		505.24			
48.86	2		560.79	$z^3\mathrm{F}^\circ_4$—$g^3\mathrm{F}_4$		
41.85	4		688.18	$y^3\mathrm{F}^\circ_2$—$h^1\mathrm{D}_2$		
25.75	20 hl		42,928.29	$z^1\mathrm{G}^\circ_4$—$g^1\mathrm{G}_4$		
22.78	3 h		43,038.62			
19.44	20		100.59	$a^3\mathrm{D}_2$—$x^1\mathrm{P}^\circ_1$		
17.82	20 hl		130.71	$z^1\mathrm{D}^\circ_2$—$i^1\mathrm{D}_2$		
2,311.45	1		249.56			
2,293.47	2 h		588.59			
92.32	3		610.45	$z^1\mathrm{D}^\circ_2$—$f^3\mathrm{P}_2$		
80.94	4 h		828.01	$z^3\mathrm{H}^\circ_5$—$e^1\mathrm{I}_6$		
76.06	1 h		43,921.97			
65.53	3		44,125.90	$z^1\mathrm{F}^\circ_3$—$h^1\mathrm{D}_2$		
56.77	50		297.36	$a^1\mathrm{D}_2$—$x^1\mathrm{D}^\circ_1$		
30.74	7		44,814.20	$y^3\mathrm{F}^\circ_2$—$i^1\mathrm{D}_2$		
07.08	1		45,294.56	$y^3\mathrm{F}^\circ_2$—$f^3\mathrm{P}_2$		
2,202.72	1		383.38	$z^1\mathrm{D}^\circ_2$—$g^3\mathrm{P}_2$		
2,195.91	4		524.94	$z^3\mathrm{F}^\circ_3$—$h^1\mathrm{D}_2$		
90.67	1		633.82	$z^1\mathrm{D}^\circ_2$—$h^3\mathrm{D}_2$		
87.87	40		45,692.22	$a^3\mathrm{F}_2$—$x^1\mathrm{P}^\circ_1$		
63.66	20 hl		46,203.12			
61.36	4		252.58	$z^1\mathrm{F}^\circ_3$—$i^1\mathrm{D}_2$		
42.81	20 hl		46,642.94			

IV. THE SPECTRUM OF NEUTRAL LANTHANUM (La I)

As in Sc and Y, the normal state of the neutral La atom is represented by a doublet-D term associated with the electron configuration ds^2. In each case, the next lowest energy is represented by a quartet-F term arising from d^2s, but in La it is only about one-third as high as in Sc or Y. The remaining metastable low terms also come from d^2s, and are exactly analogous to those in Sc and Y. The ^{2}G is narrow and inverted in all three spectra, and the predicted ^{2}S has been found in none. The odd levels are very numerous, and it is difficult to group them into terms. Indeed, parts of the tangle could not have been unraveled without the clues obtained from the new measurements of Zeeman effects.

The triads of quartet terms obtained by the addition of a $6p$ electron to the ^{3}D, ^{3}F, and ^{3}P terms of La II can be securely identified. They all lie lower than the corresponding terms of Y I. Three additional odd quartet terms, $x^4\mathrm{F}^\circ$, $y^4\mathrm{G}^\circ$, and $w^4\mathrm{D}^\circ$, at higher levels can come only from the addition of a $4f$ electron to the same limits. The doublet terms arising from the addition of a $6p$ electron to the various limits have also been certainly or probably identified by the intensities of their combinations and comparison of their levels with Y I. A number of supernumerary doublet terms must also arise from the $4f$ electron, which in this case is less firmly bound than the $6p$.

Many of the numbered odd levels which have not been grouped into terms are probably of similar origin. The high terms, 10° to 15°, probably arise from electrons of higher total quantum number.

The high even terms give much less conspicuous combinations in La I than in Sc I or Y I, and only a few of them have been found—but enough to give the ionization potential. The unassigned even levels have been numbered from 30 onward. If the strong bands of LaO in the yellow and red could be eliminated more such terms could probably be identified, and some fairly strong high temperature arc lines classified.

Table 5 gives the terms of the La I spectrum in the same general form as Table 3 does for La II. The configuration from which each term is believed to arise is given opposite its lowest component. For the odd terms, the probable parent terms in La II are indicated.

TABLE 5.—*Relative terms in the La I spectrum*

Electron configuration	Term	Level	Level separation	g			Combinations
				Adapted weight		Landé	
ds^2	$a^2D_{1\frac{1}{2}}$ $a^2D_{2\frac{1}{2}}$	0.00 1,053.20	1,053.20	0.790 1.203	6 14	0.800 1.200	$z^4F^\circ, z^4D^\circ, z^2D^\circ, z^2F^\circ, z^2P^\circ, y^2F^\circ, z^4P^\circ, z^4G^\circ, y^2D^\circ, y^2P^\circ, y^4F^\circ, x^2F^\circ, z^2G^\circ, y^4D^\circ, 3^\circ, x^4D^\circ, w^2F^\circ, v^2F^\circ, z^4S^\circ, x^2D^\circ, x^4F^\circ, x^2P^\circ, y^4P^\circ, y^4G^\circ, w^2P^\circ, u^2F^\circ, t^2F^\circ, w^2D^\circ, v^2D^\circ, w^4D^\circ, 6^\circ, 7^\circ, 8^\circ, s^2F^\circ, 9^\circ, r^2F^\circ, u^2D^\circ, v^2P^\circ, 10^\circ, 11^\circ.$
d^2s	$a^4F_{1\frac{1}{2}}$ $a^4F_{2\frac{1}{2}}$ $a^4F_{3\frac{1}{2}}$ $a^4F_{4\frac{1}{2}}$	2,668.20 3,010.01 3,494.58 4,121.61	341.81 484.57 627.03	.411 1.032 1.222 1.327	20 11 10 8	.400 1.029 1.238 1.333	$z^4F^\circ, z^4D^\circ, z^2D^\circ, z^2F^\circ, z^2P^\circ, y^2F^\circ, z^4P^\circ, z^4G^\circ, y^2D^\circ, y^2P^\circ, y^4F^\circ, x^2F^\circ, z^2G^\circ, y^4D^\circ, 7^\circ, 2^\circ, 3^\circ, w^2F^\circ, x^4D^\circ, 4^\circ, v^2F^\circ, z^4S^\circ, x^2D^\circ, x^4F^\circ, x^2P^\circ, y^4P^\circ, y^4G^\circ, y^2G^\circ, 12^\circ, 13^\circ, 14^\circ, 15^\circ.$
d^2s	$a^4P_{\frac{1}{2}}$ $a^4P_{1\frac{1}{2}}$ $a^4P_{2\frac{1}{2}}$	7,231.36 7,490.46 7,679.94	259.10 189.48	2.706 1.69 1.54	10 6 4	2.667 1.733 1.600	$z^4P^\circ, y^2F^\circ, z^4G^\circ, y^2D^\circ, x^2F^\circ, z^2S^\circ, x^4D^\circ, 3^\circ, 4^\circ, w^2F^\circ, z^4S^\circ, x^2D^\circ, x^4F^\circ, y^4P^\circ, x^2P^\circ, w^2D^\circ, t^2F^\circ, w^4D^\circ, v^2D^\circ, 6^\circ, 7^\circ, 8^\circ, s^2F^\circ, 9^\circ.$
d^2s	$a^2F_{2\frac{1}{2}}$ $a^2F_{3\frac{1}{2}}$	7,011.90 8,052.15	1,040.25	.90 1.13	3½ 5	.857 1.143	$y^2F^\circ, z^4G^\circ, z^4P^\circ, y^2D^\circ, y^4F^\circ, x^2F^\circ, z^2G^\circ, y^4D^\circ, 1^\circ, 2^\circ, w^2F^\circ, v^2F^\circ, x^2D^\circ, x^4F^\circ, x^4D^\circ, v^2F^\circ, y^4P^\circ, y^4G^\circ, y^2G^\circ, w^2P^\circ, u^2F^\circ, t^2F^\circ, w^2D^\circ, v^2D^\circ, w^4D^\circ, 7^\circ, s^2F^\circ, r^2F^\circ, u^2D^\circ, 10^\circ, 11^\circ.$
d^2s	$b^2D_{1\frac{1}{2}}$ $b^2D_{2\frac{1}{2}}$	8,446.03 9,183.77	737.74	.89 1.29	3 3	.800 1.200	$z^4G^\circ, z^4P^\circ, y^2D^\circ, y^2P^\circ, y^4F^\circ, z^2S^\circ, x^4D^\circ, 4^\circ, v^2F^\circ, z^4S^\circ, x^2D^\circ, x^4F^\circ, x^2P^\circ, y^4P^\circ, w^2P^\circ, u^2F^\circ, 5^\circ, w^2D^\circ, t^2F^\circ, v^2D^\circ, w^4D^\circ, 8^\circ, s^2F^\circ, 9^\circ, r^2F^\circ, u^2D^\circ.$
d^2s	$a^2P_{\frac{1}{2}}$ $a^2P_{1\frac{1}{2}}$	9,044.21 9,719.44	675.23	.67 1.32	1 2	.667 1.333	$y^2D^\circ, y^2P^\circ, y^4F^\circ, x^2F^\circ, z^2S^\circ, x^4D^\circ, w^2F^\circ, 4^\circ, v^2F^\circ, x^2D^\circ, x^4F^\circ, x^2P^\circ, y^4P^\circ, w^2P^\circ, 5^\circ, w^2D^\circ, w^2P^\circ, v^2D^\circ, u^2D^\circ, v^2P^\circ.$
d^2s	$a^2G_{4\frac{1}{2}}$ $a^2G_{8\frac{1}{2}}$	9,919.94 9,960.96	−41.02	1.12 .91	1 1	1.111 .889	$y^4F^\circ, x^2F^\circ, z^2G^\circ, y^2G^\circ, w^2F^\circ, z^2H^\circ, x^4F^\circ, y^2G^\circ, u^2F^\circ, y^4G^\circ, w^2D^\circ, t^2F^\circ, s^2F^\circ, 9^\circ, r^2F^\circ, y^2H^\circ.$
$a^3D.p$	$z^4F^\circ_{1\frac{1}{2}}$ $z^4F^\circ_{2\frac{1}{2}}$ $z^4F^\circ_{3\frac{1}{2}}$ $z^4F^\circ_{4\frac{1}{2}}$	13,260.36 13,631.08 15,019.55 16,243.25	370.72 1,388.47 1,223.70	1.08 1.21		1.029 1.238	$a^2D, a^4F, 31, 32, 35, e^4F, e^4D.$
$a^3D.p$	$z^4D^\circ_{0\frac{1}{2}}$ $z^4D^\circ_{1\frac{1}{2}}$ $z^4D^\circ_{2\frac{1}{2}}$ $z^4D^\circ_{3\frac{1}{2}}$	14,095.70 14,708.96 15,503.67 16,099.28	613.26 794.71 595.61				$a^2D, a^4F, 31, 32, 33, 34, e^4F, e^4D.$
$a^1D.p$	$z^2D^\circ_{2\frac{1}{2}}$ $z^2D^\circ_{1\frac{1}{2}}$	14,804.10 15,031.65	−227.55	1.08 .97		1.200 .800	$a^2D, a^4F, 31, e^2F.$
$a^1D.p$	$z^2F^\circ_{2\frac{1}{2}}$ $z^2F^\circ_{3\frac{1}{2}}$	15,196.80 16,538.44	1,341.64	.90 1.19		.857 1.143	$a^2D, a^4F, e^4D, e^2F.$
$a^1S.p$	$z^2P^\circ_{\frac{1}{2}}$ $z^2P^\circ_{1\frac{1}{2}}$	15,219.90 16,280.20	1,060.30				$a^2D, a^4F.$

TABLE 5.—*Relative terms in the La I spectrum*—Continued

Electron configuration	Term	Level	Level separation	*g* Adapted weight	*g* Landé	Combinations
$a^3\mathrm{D}.p$	$y^2\mathrm{F}^\circ_{2\frac{1}{2}}$	16, 856. 82	1, 053. 36	0. 83	0. 857	a^2D, a^4F, a^2F, a^4P.
	$y^2\mathrm{F}^\circ_{3\frac{1}{2}}$	17, 910. 18		1. 08	1. 143	
$a^3\mathrm{D}.p$	$z^4\mathrm{P}^\circ_{\frac{1}{2}}$	17, 567. 56	229. 74			a^2D, a^4F, a^2F, a^4P, b^2D.
	$z^4\mathrm{P}^\circ_{1\frac{1}{2}}$	17, 797. 30	359. 70			
	$z^4\mathrm{P}^\circ_{2\frac{1}{2}}$	18, 157. 00		1. 20	1. 600	
$a^3\mathrm{F}.p$	$z^4\mathrm{G}^\circ_{2\frac{1}{2}}$	17, 947. 16	656. 79	1. 07	. 571	a^2D, a^4F, a^2F, a^4P, b^2D, e^4F, 35.
	$z^4\mathrm{G}^\circ_{3\frac{1}{2}}$	18, 603. 95	525. 39	1. 06	. 984	
	$z^4\mathrm{G}^\circ_{4\frac{1}{2}}$	19, 129. 34	988. 06	1. 15	1. 172	
	$z^4\mathrm{G}^\circ_{5\frac{1}{2}}$	20, 117. 40		1. 27	1. 273	
$a^3\mathrm{D}.p$	$y^2\mathrm{D}^\circ_{1\frac{1}{2}}$	18, 172. 39	1, 207. 05	. 83	. 800	a^2D, a^4F, a^2F, a^4P, b^2D, a^2P, e^4F.
	$y^2\mathrm{D}^\circ_{2\frac{1}{2}}$	19, 379. 44		1. 19	1. 200	
$a^1\mathrm{D}.p$	$y^2\mathrm{P}^\circ_{1\frac{1}{2}}$	20, 019. 00	−178. 38	1. 05	1. 333	a^2D, a^4F, b^2D, a^2P, e^4F.
	$y^2\mathrm{P}^\circ_{\frac{1}{2}}$	20, 197. 38		. 60	. 667	
$a^3\mathrm{F}.p$	$y^4\mathrm{F}^\circ_{1\frac{1}{2}}$	20, 083. 02	255. 28	. 78	. 400	a^2D, a^4F, a^2F, a^2P, b^2D, a^2G, e^4F, e^2F.
	$y^4\mathrm{F}^\circ_{2\frac{1}{2}}$	20, 338. 30	425. 01	1. 01	1. 029	
	$y^4\mathrm{F}^\circ_{3\frac{1}{2}}$	20, 763. 31	620. 75	1. 18	1. 238	
	$y^4\mathrm{F}^\circ_{4\frac{1}{2}}$	21, 384. 06		1. 28	1. 333	
$a^3\mathrm{F}.p$	$x^2\mathrm{F}^\circ_{2\frac{1}{2}}$	20, 972. 22	690. 39	. 90	. 857	a^2D, a^4F, a^2F, a^4P, a^2P, a^2G, e^2F.
	$x^2\mathrm{F}^\circ_{3\frac{1}{2}}$	21, 662. 61		1. 13	1. 143	
$a^3\mathrm{F}.p$	$z^2\mathrm{G}^\circ_{3\frac{1}{2}}$	21, 447. 92	837. 93	1. 08	. 889	a^2D, a^4F, a^2F, a^2G, e^2F.
	$z^2\mathrm{G}^\circ_{4\frac{1}{2}}$	22, 285. 85		1. 13	1. 111	
$a^3\mathrm{F}.p$	$y^4\mathrm{D}^\circ_{\frac{1}{2}}$	22, 246. 64	192. 73	. 03	. 000	a^2D, a^4F, a^2F.
	$y^4\mathrm{D}^\circ_{1\frac{1}{2}}$	22, 439. 37	364. 89	1. 21	1. 200	
	$y^4\mathrm{D}^\circ_{2\frac{1}{2}}$	22, 804. 26	499. 05	1. 35	1. 371	
	$y^4\mathrm{D}^\circ_{3\frac{1}{2}}$	23, 303. 31		1. 22	1. 429	
	$1^\circ_{3\frac{1}{2}}$	23, 221. 16		1. 11		a^4F, a^2F.
	$2^\circ_{4\frac{1}{2}}$	23, 466. 85		1. 12	1. 111	a^4F, a^2F, a^2G.
$a^3\mathrm{P}.p$	$z^2\mathrm{S}^\circ_{\frac{1}{2}}$	23, 260. 90		1. 87	2. 000	a^4P, b^2D, a^2P.
	$3^\circ_{2\frac{1}{2}}$	23, 549. 42				a^4F, a^4P.
	$4^\circ_{1\frac{1}{2}}$	24, 173. 86		. 72		a^4F, a^4P, b^2D, a^2P.
$a^3\mathrm{P}.p$	$x^4\mathrm{D}^\circ_{\frac{1}{2}}$	23, 528. 38	176. 38	. 00	. 000	a^2D, a^4F, a^2F, a^4P, b^2D, a^2P.
	$x^4\mathrm{D}^\circ_{1\frac{1}{2}}$	23, 704. 76	341. 30	1. 15	1. 200	
	$x^4\mathrm{D}^\circ_{2\frac{1}{2}}$	24, 046. 06	1, 037. 36	1. 22	1. 371	
	$x^4\mathrm{D}^\circ_{3\frac{1}{2}}$	25, 083. 42		1. 41	1. 429	
$a^3\mathrm{D}.f$	$w^2\mathrm{F}^\circ_{2\frac{1}{2}}$	23, 875. 00	534. 70	. 94	. 857	a^2D, a^4F, a^2F, a^4P, a^2P, a^2G.
	$w^2\mathrm{F}^\circ_{3\frac{1}{2}}$	24, 409. 70		1. 17	1. 143	
	$v^2\mathrm{F}^\circ_{2\frac{1}{2}}$(?)	24, 507. 89	870. 57	1. 20	. 857	a^2D, a^4F, a^2F, a^4P, b^2D, a^2P.
	$v^2\mathrm{F}^\circ_{3\frac{1}{2}}$(?)	25, 378. 46		1. 13	1. 143	
$a^3\mathrm{P}.p$	$z^4\mathrm{S}^\circ_{1\frac{1}{2}}$	24, 639. 27		1. 81	2. 000	a^2D, a^4F, a^4P, b^2D.
$a^3\mathrm{F}.p$	$x^2\mathrm{D}^\circ_{1\frac{1}{2}}$	24, 762. 62	455. 63	. 88	. 800	a^2D, a^4F, a^2F, a^4P, b^2D.
	$x^2\mathrm{D}^\circ_{2\frac{1}{2}}$	25, 218. 25		1. 25	1. 200	
$a^3\mathrm{F}.f$	$x^4\mathrm{F}^\circ_{1\frac{1}{2}}$	24, 910. 39	73. 94	. 73	. 400	a^2D, a^4F, a^2F, a^2G.
	$x^4\mathrm{F}^\circ_{2\frac{1}{2}}$	24, 984. 33	396. 00	1. 11	1. 029	
	$x^4\mathrm{F}^\circ_{3\frac{1}{2}}$	25, 380. 33	616. 94	1. 23	1. 238	
	$x^4\mathrm{F}^\circ_{4\frac{1}{2}}$	25, 997. 27		1. 36	1. 333	
$a^1\mathrm{G}.p$	$z^2\mathrm{H}^\circ_{4\frac{1}{2}}$	25, 089. 50	785. 18	. 94	. 909	a^4F, a^2G.
	$z^2\mathrm{H}^\circ_{5\frac{1}{2}}$	25, 874. 68				
$a^3\mathrm{D}.p$	$x^2\mathrm{P}^\circ_{\frac{1}{2}}$	25, 453. 92	496. 47	. 92	. 667	a^2D, a^4F, a^4P, b^2D, a^2P.
	$x^2\mathrm{P}^\circ_{1\frac{1}{2}}$	25, 950. 39		1. 41	1. 333	
	31	25, 568. 49				z^2D°, z^4F°, z^4D°.
	$32_{5\frac{1}{2}}$	25, 881. 53				z^2D°, z^4D°, z^4F°.
$a^3\mathrm{P}.p$	$y^4\mathrm{P}^\circ_{\frac{1}{2}}$	25, 616. 90	26. 12	2. 29	2. 667	a^2D, a^4F, a^2F, a^4P, b^2D, a^2P.
	$y^4\mathrm{P}^\circ_{1\frac{1}{2}}$	25, 643. 02	695. 88	1. 61	1. 733	
	$y^4\mathrm{P}^\circ_{2\frac{1}{2}}$	26, 338. 90		1. 54	1. 600	
$a^3\mathrm{F}.f$	$y^4\mathrm{G}^\circ_{2\frac{1}{2}}$	27, 022. 60	432. 74	. 57	. 571	a^2D, a^4F, a^2F, a^2G.
	$y^4\mathrm{G}^\circ_{3\frac{1}{2}}$	27, 455. 34	633. 84	. 99	. 984	
	$y^4\mathrm{G}^\circ_{4\frac{1}{2}}$	28, 089. 18	654. 03	1. 16	1. 172	
	$y^4\mathrm{G}^\circ_{5\frac{1}{2}}$	28, 743. 21		1. 29	1. 273	

TABLE 5.—*Relative terms in the La I spectrum*—Continued

Electron configuration	Term	Level	Level separation	*g*		Combinations
				Adapted weight	Landé	
$a^1G.p$	$y^2G^\circ_{3\frac{1}{2}}$	27, 132. 50	487. 19	0. 95	0. 889	a^4F, a^2F, a^2G.
	$y^2G^\circ_{4\frac{1}{2}}$	27, 619. 69		1. 12	1. 111	
$b^1D.p$	$w^2P^\circ_{1\frac{1}{2}}$	27, 225. 27		1. 34	1. 333	a^2D, a^2F, b^2D, a^2P.
$b^1D.p$	$u^2F^\circ_{2\frac{1}{2}}$	27, 393. 00	646. 54	. 90	. 857	a^2D, a^2F, a^2G.
	$u^2F^\circ_{3\frac{1}{2}}$	28, 039. 54		1. 13	1. 143	
f	$t^2F^\circ_{2\frac{1}{2}}$	27, 669. 38	873. 72	. 88	. 857	a^2D, a^2F, a^2G.
	$t^2F^\circ_{3\frac{1}{2}}$	28, 543. 10		1. 00	1. 143	
	$5^\circ_{1\frac{1}{2}}$	27, 749. 05				b^2D, a^2P.
$b^1D.p$	$w^2D^\circ_{1\frac{1}{2}}$	27, 968. 53	537. 86	. 91	. 800	a^2D, a^2F, a^4P, b^2D, a^2P.
	$w^2D^\circ_{2\frac{1}{2}}$	28, 506. 39				
$a^3P.f$	$w^4D^\circ_{0\frac{1}{2}}$	28, 893. 47	306. 06	0. 00	0. 000	a^2D, a^2F, a^4P, b^2D.
	$w^4D^\circ_{1\frac{1}{2}}$	29, 199. 53	302. 64	1. 15	1. 200	
	$w^4D^\circ_{2\frac{1}{2}}$	29, 502. 17	392. 74			
	$w^4D^\circ_{3\frac{1}{2}}$	29, 894. 91		1. 29	1. 429	
f	$v^2D^\circ_{1\frac{1}{2}}$	28, 971. 82	803. 75	. 94	. 800	a^2D, a^2F, a^4P, b^2D, a^2P.
	$v^2D^\circ_{2\frac{1}{2}}$	29, 775. 57		1. 13	1. 200	
	33	29, 461. 33				z^4D°.
	$6^\circ_{\frac{1}{2}}$	29, 564. 92				a^2D, a^4P, b^2D, a^2P.
	$7^\circ_{1\frac{1}{2}}$	29, 936. 73		1. 54		a^2D, a^2F, a^4P.
	$8^\circ_{1\frac{1}{2}}$	30, 417. 47		1. 54		a^2D_1 a^4P_1 b^2D.
	34(?)	29, 594. 81				z^4D°.
$a^3F.s$	$e^4F_{1\frac{1}{2}}$	29, 874. 89	479. 43			z^4F°, z^4D°, y^4F°, z^4G°.
	$e^4F_{2\frac{1}{2}}$	30, 354. 32	705. 37			
	$e^4F_{3\frac{1}{2}}$	31, 059. 69	864. 21			
	$e^4F_{4\frac{1}{2}}$	31, 923. 90				
$a^1G.p$	$s^2F^\circ_{2\frac{1}{2}}$	30, 788. 40	176. 42			a^2D, a^4P, a^2F, b^2D, a^2G.
	$s^2F^\circ_{3\frac{1}{2}}$	30, 964. 82		1. 18	1. 143	
	$9^\circ_{2\frac{1}{2}}$	30, 896. 88		1. 45		a^2D, a^4P, b^2D, a^2G.
$a^3F.s$	$e^2F_{2\frac{1}{2}}$	31, 119. 08	989. 50			z^2D°, z^2F°, y^4F°, z^2G°.
	$e^2F_{3\frac{1}{2}}$	32, 108. 58				
$a^3D.s$	$e^4D_{3\frac{1}{2}}$	31, 287. 65				z^4F°, z^4D°, z^2F°.
f	$r^2F^\circ_{2\frac{1}{2}}$	31, 477. 16		. 88	. 857	a^2D, a^2F, b^2D, a^2G.
	$r^2F^\circ_{3\frac{1}{2}}$	32, 140. 60		1. 18	1. 143	
$a^3P.p$	$u^2D^\circ_{1\frac{1}{2}}$	31, 751. 68	741. 12	. 82	. 800	a^2D, a^2F, b^2D, a^2P.
	$u^2D^\circ_{2\frac{1}{2}}$	32, 492. 80		1. 17	1. 200	
$a^3P.p$	$v^2P^\circ_{\frac{1}{2}}$	32, 290. 25	913. 95			a^2D, b^2D, a^2P.
	$v^2P^\circ_{1\frac{1}{2}}$	33, 204. 20		1. 26	1. 333	
$a^1G.f$	$y^2H^\circ_{4\frac{1}{2}}$	32, 410. 76	107. 36	. 93	. 909	a^2G.
	$y^2H^\circ_{5\frac{1}{2}}$	32, 518. 12		1. 11	1. 091	
	35	33, 286. 50				z^4F°, z^2F°, y^2F°, z^4G°.
	10°	36, 722. 38				a^2D, a^2F.
	11°	37, 731. 90				a^2D, a^2F.
	12°(?)	39, 597. 58				a^4F.
	13°	39, 631. 27				a^4F.
	14°	40, 322. 45				a^4F.
	15°	40, 343. 40				a^4F.

The spectral terms and combinations for La I are represented diagrammatically in Figure 2, which may be compared with corresponding diagrams for Sc I and Y I spectra in publications already referred to.[25]

Complete details of lines regarded as characteristic of neutral lanthanum atoms are given in Table 6, the arrangement and notation being the same as that in Table 4. Here again the Zeeman patterns computed from the adopted *g* values are almost always in good agreement with observation.

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[25] See footnotes 2 and 3, p. 625.

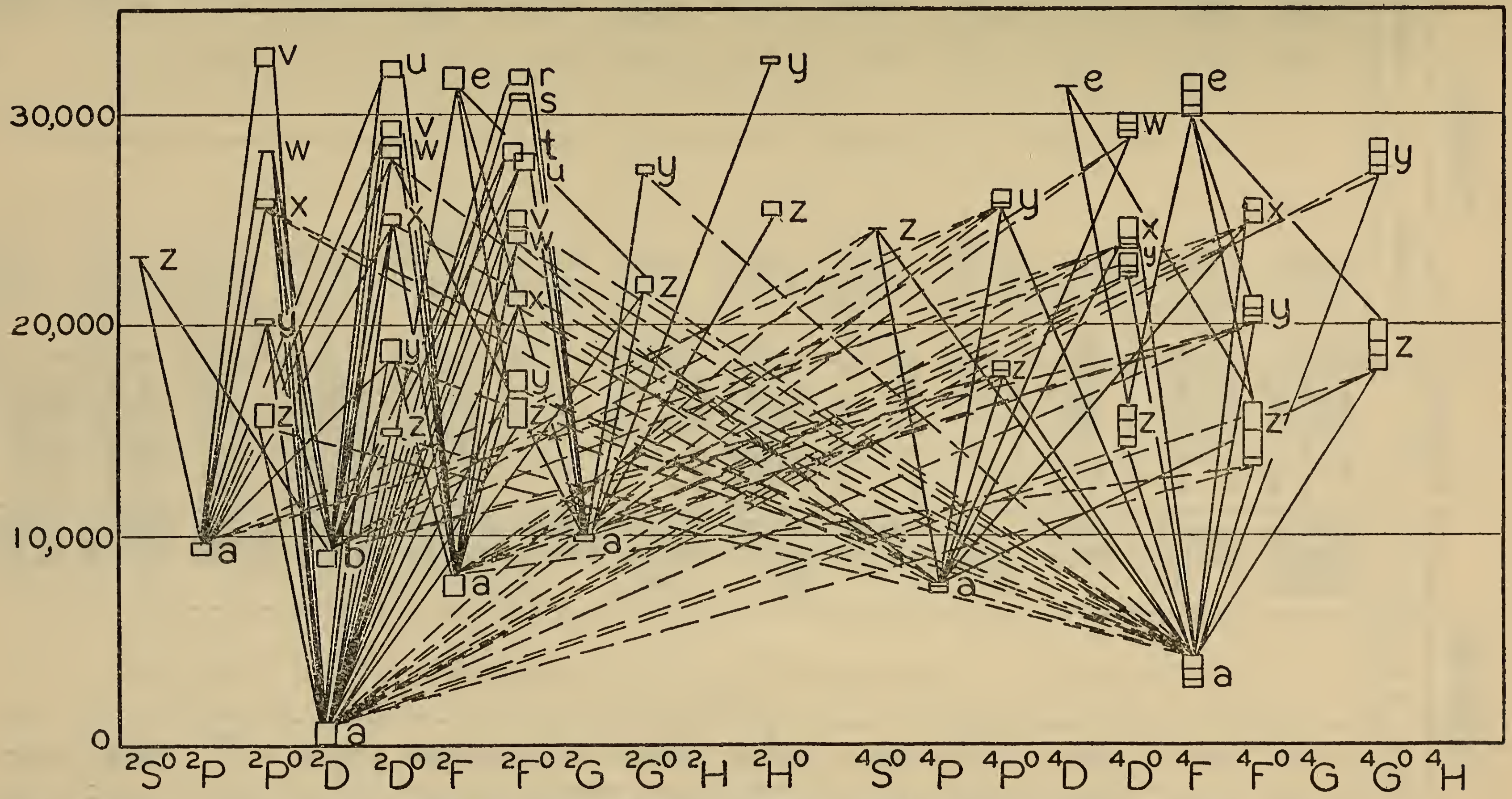

FIGURE 2.—*Terms and combinations in the La I spectrum*

TABLE 6.—*The arc spectrum of lanthanum (La I)*

λ_{air} I. A.	Intensities, temperature class		ν_{vac} cm^{-1}	Term combination	Zeeman effects	
	B. S.	K. & C.			Observed	Computed
10, 952. 0	1		9, 128. 25	$a^{2}P_{\frac{1}{2}}$—$y^{2}D^{\circ}_{1\frac{1}{2}}$		
10, 739. 66	5		9, 308. 73			
10, 612. 56	10		9, 420. 21	$b^{2}D_{2\frac{1}{2}}$—$z^{4}G^{\circ}_{3\frac{1}{2}}$		
10, 552. 41	6		9, 473. 91			
10, 522. 09	10		9, 501. 21	$b^{2}D_{1\frac{1}{2}}$—$z^{4}G^{\circ}_{2\frac{1}{2}}$		
10, 483. 0	2		36. 6	$y^{4}F^{\circ}_{2\frac{1}{2}}$—$e^{4}F_{1\frac{1}{2}}$		
61. 69	15		56. 07			
50. 82	20		66. 01			
23. 4	1		9, 591. 2	$y^{4}F^{\circ}_{3\frac{1}{2}}$—$e^{4}F_{2\frac{1}{2}}$		
10, 409. 55	3		9, 603. 93			
10, 372. 4	1		38. 4	$z^{4}F^{\circ}_{4\frac{1}{2}}$—32		
57. 70	20		52. 01			
49. 08	40		60. 05	$a^{2}P_{1\frac{1}{2}}$—$y^{2}D^{\circ}_{2\frac{1}{2}}$		
37. 20	3		71. 15	$z^{2}G^{\circ}_{3\frac{1}{2}}$—$e^{2}F_{2\frac{1}{2}}$		
32. 40	2		75. 64	$y^{4}F^{\circ}_{4\frac{1}{2}}$—$e^{4}F_{3\frac{1}{2}}$		
30. 3	1		77. 6	$y^{2}P^{\circ}_{1\frac{1}{2}}$—$e^{4}F_{1\frac{1}{2}}$		
10, 318. 2	2		9, 689. 0			
10, 294. 68	10 d		9, 711. 09	$b^{2}D_{1\frac{1}{2}}$—$z^{4}P^{\circ}_{2\frac{1}{2}}$		
85. 64	3		21. 52			
81. 34	10		23. 69			
78. 52	3		26. 37	$b^{2}D_{1\frac{1}{2}}$—$y^{2}D^{\circ}_{1\frac{1}{2}}$		
74. 85	10		29. 84			
34. 78	2		67. 93			
23. 76	1		78. 46			
19. 83	3		82. 22	$z^{4}D^{\circ}_{3\frac{1}{2}}$—32		
10, 209. 85	2		9, 791. 78	$y^{4}F^{\circ}_{1\frac{1}{2}}$—$e^{4}F_{1\frac{1}{2}}$		
10, 184. 60	20		9, 816. 06			
77. 74	6 h		22. 67	$z^{2}G^{\circ}_{4\frac{1}{2}}$—$e^{2}F_{3\frac{1}{2}}$		
54. 74	40		44. 92	$a^{2}F_{2\frac{1}{2}}$—$y^{2}F^{\circ}_{2\frac{1}{2}}$		
43. 38	2		55. 95	$y^{2}P^{\circ}_{1\frac{1}{2}}$—$e^{4}F_{1\frac{1}{2}}$		
41. 20	10		58. 06	$a^{2}F_{3\frac{1}{2}}$—$y^{2}F^{\circ}_{3\frac{1}{2}}$		
30. 82	5		68. 17			
10, 111. 9	2 h		9, 886. 6			
10, 083. 96	2		9, 914. 03			
66. 77	6		30. 95			
58. 79	2		34. 84			
54. 82	2		42. 76			
29. 74	2		67. 62			
14. 45	4		82. 84			
10, 005. 73	50		9, 991. 54			
9, 988. 47	10		10, 008. 80			
81. 24	6		016. 05	$y^{4}F^{\circ}_{2\frac{1}{2}}$—$e^{4}F_{2\frac{1}{2}}$		
80. 38	10		016. 91			
65. 70	3		031. 67			
32. 72	2		064. 98	$z^{4}D^{\circ}_{2\frac{1}{2}}$—31		
20. 82	150		077. 06	$a^{4}P_{1\frac{1}{2}}$—$z^{4}P_{\frac{1}{2}}$		
9, 911. 08	3		085. 95			
9, 881. 24	100		117. 42	$a^{4}P_{2\frac{1}{2}}$—$z^{4}P^{\circ}_{1\frac{1}{2}}$		
62. 60	3		136. 54	$a^{4}F_{3\frac{1}{2}}$—$z^{4}F^{\circ}_{2\frac{1}{2}}$		
52. 58	6		146. 85	$x^{2}F^{\circ}_{2\frac{1}{2}}$—$e^{2}F_{2\frac{1}{2}}$		
48. 70	4		150. 84			
42. 0	2		157. 8			
33. 30	3 h		166. 74			
05. 2	1 h		195. 9	$b^{2}D_{2\frac{1}{2}}$—$y^{2}D^{\circ}_{2\frac{1}{2}}$		
9, 804. 20	2		196. 92			
9, 775. 09	8		227. 28			
72. 24	20		230. 26	$a^{4}P_{2\frac{1}{2}}$—$y^{2}F^{\circ}_{3\frac{1}{2}}$		
68. 82	3 h		233. 85			
37. 09	100		267. 20	$a^{4}P_{2\frac{1}{2}}$—$z^{4}G^{\circ}_{2\frac{1}{2}}$		
13. 52	3		292. 11			
09. 45	10		296. 42	$y^{4}F^{\circ}_{3\frac{1}{2}}$—$e^{4}F_{3\frac{1}{2}}$		
9, 706. 48	20		299. 57	$a^{2}P_{1\frac{1}{2}}$—$y^{2}P^{\circ}_{1\frac{1}{2}}$		
9, 699. 64	20		306. 84	$a^{4}P_{1\frac{1}{2}}$—$z^{4}P^{\circ}_{1\frac{1}{2}}$		
96. 7	1		310. 0			
92. 6	2		314. 3			

TABLE 6.—*The arc spectrum of lanthanum (La* I*)*—Continued

λ air I. A.	Intensities, temperature class		ν vac cm⁻¹	Term combination	Zeeman effects	
	B. S.	K. & C.			Observed	Computed
72. 04	8		336. 25	$a^{4}\mathrm{P}_{\frac{1}{2}}-z^{4}\mathrm{P}^{\circ}_{0\frac{1}{2}}$		
46. 47	3		363. 65	$a^{2}\mathrm{P}_{1\frac{1}{2}}-y^{4}\mathrm{F}^{\circ}_{1\frac{1}{2}}$		
40. 81	30		369. 73			
33. 72	40		377. 36	$a^{2}\mathrm{G}_{3\frac{1}{2}}-y^{4}\mathrm{F}^{\circ}_{2\frac{1}{2}}$		
9, 631. 84	2		379. 38			
9, 570. 38	5		446. 04	$x^{2}\mathrm{F}^{\circ}_{3\frac{1}{2}}-e^{2}\mathrm{F}_{3\frac{1}{2}}$		
60. 69	10		456. 63	$a^{4}\mathrm{P}_{1\frac{1}{2}}-z^{4}\mathrm{G}^{\circ}_{2\frac{1}{2}}$		
42. 06	50		477. 05	$a^{4}\mathrm{P}_{2\frac{1}{2}}-z^{4}\mathrm{P}^{\circ}_{2\frac{1}{2}}$		
41. 23	20		477. 96	$a^{2}\mathrm{P}_{1\frac{1}{2}}-y^{2}\mathrm{P}^{\circ}_{0\frac{1}{2}}$		
9, 528. 0	1 h		492. 5	$a^{4}\mathrm{P}_{2\frac{1}{2}}-y^{2}\mathrm{D}^{\circ}_{1\frac{1}{2}}$		
9, 485. 15	15		539. 91	$y^{4}\mathrm{F}^{\circ}_{4\frac{1}{2}}-e^{4}\mathrm{F}_{4\frac{1}{2}}$		
84. 2	1		541. 0			
76. 98	3		548. 99	$z^{4}\mathrm{F}^{\circ}_{3\frac{1}{2}}-31$		
74. 45	5		551. 81	$a^{2}\mathrm{F}_{3\frac{1}{2}}-z^{4}\mathrm{G}^{\circ}_{3\frac{1}{2}}$		
67. 25	2		559. 84			
61. 82	60		565. 89	$a^{4}\mathrm{P}\ _{\frac{1}{2}}-z^{4}\mathrm{P}^{\circ}_{1\frac{1}{2}}$		
57. 62	2		570. 59			
41. 7	1		588. 4			
38. 30	100		592. 23	$a^{4}\mathrm{F}_{1\frac{1}{2}}-z^{4}\mathrm{F}^{\circ}_{1\frac{1}{2}}$		
15. 64	3		617. 71			
9, 412. 65	100		621. 08	$a^{4}\mathrm{F}_{2\frac{1}{2}}-z^{4}\mathrm{F}^{\circ}_{2\frac{1}{2}}$		
9, 398. 2	1		637. 4			
90. 56	4		646. 07			
77. 71	3		660. 66	$z^{2}\mathrm{G}^{\circ}_{3\frac{1}{2}}-e^{2}\mathrm{F}_{3\frac{1}{2}}$		
76. 10	3		662. 49			
72. 57	30		666. 51	$a^{4}\mathrm{P}_{1\frac{1}{2}}-z^{4}\mathrm{P}^{\circ}_{2\frac{1}{2}}$		
28. 87	2		716. 47			
24. 5	1		721. 5	$y^{4}\mathrm{F}^{\circ}_{2\frac{1}{2}}-e^{4}\mathrm{F}_{3\frac{1}{2}}$		
9. 321. 9	1 h		724. 5	$y^{4}\mathrm{F}^{\circ}_{4\frac{1}{2}}-e^{2}\mathrm{F}_{3\frac{1}{2}}$		
9, 293. 3	2 h		757. 5			
87. 5	1 h		764. 2	$z^{2}\mathrm{D}^{\circ}_{2\frac{1}{2}}-31$		
54. 70	10		802. 36	$a^{2}\mathrm{G}_{3\frac{1}{2}}-y^{4}\mathrm{F}^{\circ}_{3\frac{1}{2}}$		
50. 06	20		807. 78			
26. 63	30		835. 22	$b^{2}\mathrm{D}_{2\frac{1}{2}}-y^{2}\mathrm{P}^{\circ}_{1\frac{1}{2}}$		
9, 219. 64	10		843. 44	$a^{2}\mathrm{G}_{4\frac{1}{2}}-y^{4}\mathrm{F}^{\circ}_{3\frac{1}{2}}$		
9, 172. 88	5		898. 71			
72. 39	10		899. 30	$b^{2}\mathrm{D}_{2\frac{1}{2}}-y^{4}\mathrm{F}^{\circ}_{1\frac{1}{2}}$		
57. 13	10		917. 46			
51. 62	6		924. 03	$a^{4}\mathrm{P}_{2\frac{1}{2}}-z^{4}\mathrm{G}^{\circ}_{3\frac{1}{2}}$		
43. 78	5		933. 40	$b^{2}\mathrm{D}_{1\frac{1}{2}}-y^{2}\mathrm{D}^{\circ}_{2\frac{1}{2}}$		
42. 24	6		935. 24	$a^{2}\mathrm{D}_{1\frac{1}{2}}-z^{4}\mathrm{G}^{\circ}_{2\frac{1}{2}}$		
19. 18	20		962. 89	$a^{4}\mathrm{F}_{1\frac{1}{2}}-z^{4}\mathrm{F}^{\circ}_{2\frac{1}{2}}$		
9, 109. 25	2		10, 974. 84	$a^{2}\mathrm{P}_{\frac{1}{2}}-y^{2}\mathrm{P}^{\circ}_{1\frac{1}{2}}$		
9, 079. 10	50		11, 011. 29	$a^{2}\mathrm{G}_{3\frac{1}{2}}-x^{2}\mathrm{F}^{\circ}_{2\frac{1}{2}}$		
58. 63	2		036. 17	$y^{4}\mathrm{F}^{\circ}_{1\frac{1}{2}}-e^{2}\mathrm{F}_{2\frac{1}{2}}$		
56. 53	5		038. 73	$a^{2}\mathrm{P}_{\frac{1}{2}}-y^{4}\mathrm{F}^{\circ}_{1\frac{1}{2}}$		
46. 97	2		050. 39			
25. 05	4		077. 23	$a^{2}\mathrm{F}_{3\frac{1}{2}}-z^{4}\mathrm{G}^{\circ}_{4\frac{1}{2}}$		
9, 008. 26	6		097. 88			
8, 977. 39	2		136. 04	$x^{2}\mathrm{F}^{\circ}_{2\frac{1}{2}}-e^{2}\mathrm{F}_{3\frac{1}{2}}$		
70. 07	3		145. 13	$a^{2}\mathrm{F}_{2\frac{1}{2}}-z^{4}\mathrm{P}^{\circ}_{2\frac{1}{2}}$		
65. 41	2		150. 92			
63. 63	10		153. 13	$a^{2}\mathrm{P}_{\frac{1}{2}}-y^{2}\mathrm{P}^{\circ}_{0\frac{1}{2}}$		
57. 74	50		160. 47	$a^{2}\mathrm{F}_{2\frac{1}{2}}-y^{2}\mathrm{D}^{\circ}_{1\frac{1}{2}}$		
48. 89	2		171. 50			
47. 95	1		172. 68			
8, 917. 70	1 h		210. 58			
8, 891. 06	1		244. 17			
84. 24	2		252. 80	$a^{2}\mathrm{P}_{1\frac{1}{2}}-x^{2}\mathrm{F}^{\circ}_{2\frac{1}{2}}$		
79. 56	3		258. 73			
75. 05	2		264. 45			
71. 00	4		269. 60			
67. 35	3		274. 24			
39. 64	20		309. 57	$a^{4}\mathrm{F}_{3\frac{1}{2}}-z^{2}\mathrm{D}^{\circ}_{2\frac{1}{2}}$		
25. 86	50		327. 23	$a^{2}\mathrm{F}_{3\frac{1}{2}}-y^{2}\mathrm{D}^{\circ}_{2\frac{1}{2}}$		

TABLE 6.—*The arc spectrum of lanthanum (La I)*—Continued

λ_{air} I. A.	Intensities, temperature class		ν_{vac} cm^{-1}	Term combination	Zeeman effects	
	B. S.	K. & C.			Observed	Computed
21.66	1 h		332.62			
8,818.96	20		336.10			
8,797.6	2 h		363.6			
72.02	1		396.76			
67.92	4		402.07			
60.4	1		411.9			
48.42	50		427.50	$a^4F_{1\frac{1}{2}}-z^4D^{\circ}_{0\frac{1}{2}}$		
24.12	1		459.33			
20.42	20		464.19	$a^2G_{4\frac{1}{2}}-y^4P^{\circ}_{4\frac{1}{2}}$		
8,703.13	5		486.97	$a^2G_{3\frac{1}{2}}-z^2G^{\circ}_{3\frac{1}{2}}$		
8,674.40	60		525.01	$a^4F_{3\frac{1}{2}}-z^4F_{3\frac{1}{2}}$		
72.10	30		528.07	$a^2G_{4\frac{1}{2}}-z^2G^{\circ}_{3\frac{1}{2}}$		
38.4	10		573.0	$b^2D_{1\frac{1}{2}}-y^2P^{\circ}_{1\frac{1}{2}}$		
24.22	6		592.07	$a^2F_{2\frac{1}{2}}-z^4G^{\circ}_{3\frac{1}{2}}$		
8,621.55	2		595.66			
8,590.97	6		636.94	$b^2D_{1\frac{1}{2}}-y^4F^{\circ}_{1\frac{1}{2}}$		
58.9	1		680.5	$y^2D^{\circ}_{2\frac{1}{2}}-e^4F_{3\frac{1}{2}}$		
45.44	50		698.94	$a^4F_{2\frac{1}{2}}-z^4D^{\circ}_{1\frac{1}{2}}$		
43.46	20		701.65	$a^2G_{3\frac{1}{2}}-x^2F^{\circ}_{3\frac{1}{2}}$		
29.68	3		720.55			
13.55	15		742.76	$a^2G_{4\frac{1}{2}}-x^2F^{\circ}_{3\frac{1}{2}}$		
8,507.37	10		751.29	$b^2D_{1\frac{1}{2}}-y^2P^{\circ}_{0\frac{1}{2}}$		
8,476.48	30		794.12	$a^4F_{2\frac{1}{2}}-z^2D^{\circ}_{2\frac{1}{2}}$		
67.62	15		806.45	$z^4G^{\circ}_{5\frac{1}{2}}-e^4F_{4\frac{1}{2}}$		
8,440.06	3		845.01			
8,379.80	20		930.18	$z^4G^{\circ}_{4\frac{1}{2}}-e^4F^{\circ}_{3\frac{1}{2}}$		
58.50	2 h		960.59			
46.60	100	12, III	977.64	$a^4F_{4\frac{1}{2}}-z^4D^{\circ}_{3\frac{1}{2}}$		
34.44	3		11,995.11			
24.72	100	15, III	12,009.12	$a^4F_{3\frac{1}{2}}-z^4D^{\circ}_{2\frac{1}{2}}$		
24.59	HNR	1, III A	009.30	$a^4F_{2\frac{1}{2}}-z^4F^{\circ}_{3\frac{1}{2}}$		
16.05	10	2, IV A	021.64	$a^4F_{2\frac{1}{2}}-z^2D^{\circ}_{1\frac{1}{2}}$		
8,302.82	4		040.80	$a^4F_{1\frac{1}{2}}-z^4D^{\circ}_{1\frac{1}{2}}$		
8,247.46	60	10, III	121.62	$a^4F_{4\frac{1}{2}}-z^4F^{\circ}_{4\frac{1}{2}}$		
37.90	3		135.68	$a^4F_{1\frac{1}{2}}-z^2D^{\circ}_{2\frac{1}{2}}$		
11.65	2		174.48			
8,203.38	3		186.75	$a^4F_{2\frac{1}{2}}-z^2F^{\circ}_{2\frac{1}{2}}$		
8,086.10	20+M	15, III	363.50	$a^4F_{1\frac{1}{2}}-z^2D^{\circ}_{1\frac{1}{2}}$		
84.53	3		365.92	$a^2G_{4\frac{1}{2}}-z^2G^{\circ}_{4\frac{1}{2}}$		
51.38	10	10, III	416.82	$a^4F_{4\frac{1}{2}}-z^2F^{\circ}_{3\frac{1}{2}}$		
8,001.91	4	4, III A	493.58	$a^4F_{2\frac{1}{2}}-z^4D^{\circ}_{2\frac{1}{2}}$		
7,964.86	5	6, III	551.70	$a^4F_{1\frac{1}{2}}-z^2P^{\circ}_{0\frac{1}{2}}$		
48.30	HNR	10, III	577.85	$a^2D_{2\frac{1}{2}}-z^4F^{\circ}_{2\frac{1}{2}}$		
7,931.18	1		605.00	$a^4F_{3\frac{1}{2}}-z^4D^{\circ}_{3\frac{1}{2}}$		
7,864.98	1		711.10	$a^2F_{3\frac{1}{2}}-y^4F^{\circ}_{3\frac{1}{2}}$		
7,841.76	3		748.74	$a^4F_{3\frac{1}{2}}-z^4F^{\circ}_{4\frac{1}{2}}$		
7,737.74	1 h		12,920.12	$a^2F_{3\frac{1}{2}}-x^2F^{\circ}_{2\frac{1}{2}}$		
7,664.38	4	? III	13,043.78	$a^4F_{3\frac{1}{2}}-z^2F^{\circ}_{3\frac{1}{2}}$		
7,539.24	10	15, II	260.29	$a^2D_{1\frac{1}{2}}-z^4F^{\circ}_{1\frac{1}{2}}$		
33.64	2		270.14	$a^4F_{2\frac{1}{2}}-z^2P_{1\frac{1}{2}}$		
7,501.78	1		326.50	$a^2F_{2\frac{1}{2}}-y^4F^{\circ}_{2\frac{1}{2}}$		
7,498.82	2	5, III A	331.76	$a^2F_{3\frac{1}{2}}-y^4F^{\circ}_{4\frac{1}{2}}$		
7,463.08	5	10, III	395.61	$a^2F_{3\frac{1}{2}}-z^2G^{\circ}_{3\frac{1}{2}}$		
7,382.73	6	5, III A	541.40	$a^2P_{1\frac{1}{2}}-z^2S^{\circ}_{\frac{1}{2}}$		
79.71		10, III A	546.94	$a^2G_{4\frac{1}{2}}-y^2G^{\circ}_{4\frac{1}{2}}$		
45.36	25	20, III A	610.30	$a^2F_{3\frac{1}{2}}-x^2F^{\circ}_{3\frac{1}{2}}$	(0.42) 1.18 ?	(0.39) 1.06
44.42	HNR	2, III A	612.03	$a^4F_{1\frac{1}{2}}-z^2P^{\circ}_{1\frac{1}{2}}$		
34.18	50	60, II	631.04	$a^2D_{1\frac{1}{2}}-z^4F^{\circ}_{2\frac{1}{2}}$	(0.00w) 1.30 w	(0.00) 1.30
20.90	2		655.77	$a^2D_{2\frac{1}{2}}-z^4D^{\circ}_{2\frac{1}{2}}$		
7,308.46	2 h		679.01	$a^2S_{\frac{1}{2}}-{}^4S^{\circ}_{1\frac{1}{2}}$		
7,285.83	1		721.50			
70.30	HNR	5, II A	750.81	$a^2D_{2\frac{1}{2}}-z^2D^{\circ}_{2\frac{1}{2}}$		
70.07	HNR	10, III	751.24	$a^2F_{2\frac{1}{2}}-y^4F^{\circ}_{3\frac{1}{2}}$		
63.68	2		763.34			
62.83	2		764.95			

TABLE 6.—*The arc spectrum of lanthanum (La I)*—Continued

λ air I. A.	Intensities, temperature class		ν vac cm^{-1}	Term combination	Zeeman effects	
	B. S.	K. & C.			Observed	Computed
50.38	1		788.59	$a^4F_{4\frac{1}{2}}-y^2F^{\circ}_{3\frac{1}{2}}$		
19.92	15	15, II A	846.76	$a^4F_{2\frac{1}{2}}-y^2F^{\circ}_{2\frac{1}{2}}$		
7,217.16	2		852.06			
7,161.25	40	50, III	960.20	$a^2F_{2\frac{1}{2}}-x^2F^{\circ}_{2\frac{1}{2}}$	(0.00) 0.91	(0.00) 0.90
58.11	30	50, III A	966.32	$a^2D_{2\frac{1}{2}}-z^4F^{\circ}_{3\frac{1}{2}}$	(0.00) 1.27	(0.00) 1.22
51.92	HNR	1, III A	978.42	$a^2D2\frac{1}{2}-z^2D^{\circ}_{1\frac{1}{2}}$		
7,149.76	2	2, III	13,982.63	$a^4P_{2\frac{1}{2}}-x^2F^{\circ}_{3\frac{1}{2}}$		
7,098.18	2		14,084.24			
92.40	HNR	2, I A	095.72	$a^2D_{1\frac{1}{2}}-z^4D^{\circ}_{1\frac{1}{2}}$		
76.36	3	3, III	127.67			
68.37	60	100, II	143.64	$a^2D_{2\frac{1}{2}}-z^2F^{\circ}_{2\frac{1}{2}}$	(0.69)?	(0.66) 1.05
62.4	1 h		155.6	$a^2P_{1\frac{1}{2}}-w^2F^{\circ}_{2\frac{1}{2}}$		
45.96	200	300, II	188.62	$a^4F_{1\frac{1}{2}}-y^2F^{\circ}_{22\frac{1}{2}}$	(**0.21**, 0.65) 1.04, **1.47**	(**0.21**, 0.62) 0.20, 0.63 **1.04, 1.46**
32.07	25	15, III	216.65	$a^2P_{\frac{1}{2}}-z^2S^{\circ}_{0\frac{1}{2}}$	(0.60) 1.27	(0.60) 1.27
23.67	150	150, III	233.66	$a^2F_{3\frac{1}{2}}-z^2G^{\circ}_{4\frac{1}{2}}$	(0.00) 1.16	(0.00) 1.16
7,013.15	2		255.00	$z^4D^{\circ}_{3\frac{1}{2}}-e^4F_{2\frac{1}{2}}$		
6,978.09	2		326.62	$a^2P_{1\frac{1}{2}}-x^4D^{\circ}_{2\frac{1}{2}}$		
76.87	2	3, III	329.13			
35.03	50	50, III	415.58	$a^4F_{3\frac{1}{2}}-y^2F^{\circ}_{3\frac{1}{2}}$	(0.48) 1.14	(0.41) 1.15
25.27	80	100, III	435.90	$a^2F_{2\frac{1}{2}}-z^2G^{\circ}_{3\frac{1}{2}}$	(0.00w) 1.58 A^2	(0.00) 1.53 A^2
18.33	8	8, III A	450.38	$a^2D_{2\frac{1}{2}}-z^4D^{\circ}_{3\frac{1}{2}}$		
17.26	10	10, III A	452.61	$a^4F_{3\frac{1}{2}}-z^4G^{\circ}_{2\frac{1}{2}}$		
03.08	2	1, III A	482.30	$a^4F_{4\frac{1}{2}}-z^4G^{\circ}_{3\frac{1}{2}}$		
6,902.08	3	1, III	484.40	$a^2P_{\frac{1}{2}}-x^4D^{\circ}_{0\frac{1}{2}}$		
6,889.63	2 h	tr, V	489.54	$a^2G_{4\frac{1}{2}}-w^2F^{\circ}_{3\frac{1}{2}}$		
98.41		tr, V	492.10	----------------		
23.80	40	15, II A	650.56	$a^2F_{2\frac{1}{2}}-x^2F^{\circ}_{3\frac{1}{2}}$	(0.00) 1.15	(0.00) 1.12
21.51	5 d	3n, V	655.47			
19.14	1		660.57	$a^2P_{\frac{1}{2}}-x^4D^{\circ}_{1\frac{1}{2}}$		
6,816.29		1n, V?	666.70			
6,796.73	4	4, II A	708.90	$a^2D1\frac{1}{2}-z^4D^{\circ}_{1\frac{1}{2}}$		
83.55	1	tr, IV A	737.48			
78.19	1	tr, V	749.14	$z^2F^{\circ}_{3\frac{1}{2}}-e^4D_{3\frac{1}{2}}$		
76.69	1	1, III A	752.40	$z^4O_{1\frac{1}{2}}-33$		
60.73	HNR	1, III A	787.23	$a^4F_{2\frac{1}{2}}-z^4P^{\circ}_{1\frac{1}{2}}$		
60.23	1		788.32	$a^2P_{1\frac{1}{2}}-v^2P^{\circ}_{2\frac{1}{2}}$		
53.05	40	50, I A	804.04	$a^2D_{1\frac{1}{2}}-z^2D^{\circ}_{2\frac{1}{2}}$	(0.00 w) 1.51 A^2	(0.00) 1.51 A^2
48.12	10	10, II A	814.86	$b^2D_{1\frac{1}{2}}-z^2S^{\circ}_{0\frac{1}{2}}$		
41.20	2		830.07			
37.29	1		838.67			
15.96		1, IVA?	885.80	$z^4D^{\circ}_{1\frac{1}{2}}-34$		
6,709.49	150	200, I	900.16	$a^4F_{2\frac{1}{2}}-y^2F^{\circ}_{3\frac{1}{2}}$	(0.00) 1.18	(0.00) 1.14
6,699.86	3	4, III A	921.57			
99.26	2	2, III?	922.91			
92.86	20	30, I A	14,937.18	$a^4F_{2\frac{1}{2}}-z^4G^{\circ}_{2\frac{1}{2}}$	(0.00) 1.06	(0.09) 1.05
64.45	1		15,000.85			
61.40	60	80, I A	007.72	$a^4F_{4\frac{1}{2}}-z^4G^{\circ}_{4\frac{1}{2}}$	(0.65) 1.23 B?	(0.66) 1.24
58.06	1		015.25	$a^4P_{\frac{1}{2}}-y^4D^{\circ}_{0\frac{1}{2}}$		
50.81	80	100, I A	031.62	$a^2D_{1\frac{1}{2}}-z^2D^{\circ}_{1\frac{1}{2}}$	(0.00 w) 0.88	(0.25) 0.88
45.15	7	8, IV	044.42	$z^4F^{\circ}_{4\frac{1}{2}}-e^4D_{3\frac{1}{2}}$		
44.40	30	40, I A	046.12	$a^2D_{2\frac{1}{2}}-z^4D^{\circ}_{3\frac{1}{2}}$		
31.20	3	3, V?	076.07			
28.4	1	1, IV A	082.4	$b^2D_{1\frac{1}{2}}-x^4D^{\circ}_{0\frac{1}{2}}$		
16.59	60	80, I	109.36	$a^4F_{3\frac{1}{2}}-z^4G^{\circ}_{3\frac{1}{2}}$	(0.59) 1.12 B	(0.47) 1.14
12.48	3		118.75			
08.25	40	40, II	128.43	$a^2G_{3\frac{1}{2}}-z^2H^{\circ}_{4\frac{1}{2}}$	(0.00) 1.01	(0.00) 1.00
07.7	1	.3, IV	129.7	$a^2P_{\frac{1}{2}}-4^{\circ}_{1\frac{1}{2}}$		
6,600.17	25	50, II A	146.95	$a^4F_{2\frac{1}{2}}-z^4P^{\circ}_{2\frac{1}{2}}$	(0.35) 1.12	(0.37) 1.12
6,599.48		tr, IV A	148.53			
93.45	40	60, I	162.39	$a^4F_{2\frac{1}{2}}-y^2D^{\circ}_{1\frac{1}{2}}$	(0.00 w) 1.30 A^2	(0.00) 1.33 A^2
90.59	1		168.97	$a^2F_{3\frac{1}{2}}-1^{\circ}_{3\frac{1}{2}}$		
82.18	4	6, IV	188.35	$z^4D^{\circ}_{3\frac{1}{2}}-e^4D_{3\frac{1}{2}}$	(0.00 h) 1.41	
78.51	200	400, I	196.82	$a^2D_{1\frac{1}{2}}-z^2F^{\circ}_{2\frac{1}{2}}$	(0.00) 1.00	(0.00) 0.98
68.54	1		219.89	$a^2D_{1\frac{1}{2}}-z^2P^{\circ}_{0\frac{1}{2}}$		
65.45	40	40, I A	227.05	$a^2D_{2\frac{1}{2}}-z^2P^{\circ}_{1\frac{1}{2}}$		

TABLE 6.—*The arc spectrum of lanthanum (La I)*—Continued

λ air I. A.	Intensities, temperature class		ν vac cm^{-1}	Term combination	Zeeman effects	
	B. S.	K. & C.			Observed	Computed
55.95		3, III A	249.12			
55.11	2	1, V	251.07	$a^{2}F_{3\frac{1}{2}}$—$y^{4}D_{3\frac{1}{2}}$		
51.78	1		258.82	$b^{2}D_{1\frac{1}{2}}$—$x^{4}D^{\circ}_{1\frac{1}{2}}$		
49.16	2	2 n, III?	264.92	$a^{2}P_{1\frac{1}{2}}$—$x^{4}F^{\circ}_{2\frac{1}{2}}$		
43.17	300	500, I	278.90	$a^{4}F_{1\frac{1}{2}}$—$z^{4}G^{\circ}_{2\frac{1}{2}}$	(0.33, 0.99) 0.00, 0.74, 1.41, 2.07	(0.33, 0.99) 0.08, 0.75, 1.40, 2.06
23.86	2	2, III A?	324.12	$b^{2}D_{2\frac{1}{2}}$—$v^{2}F^{\circ}_{2\frac{1}{2}}$		
20.70	15	20, IV	331.55		(0.00 h) 1.10 h	
19.30	3	4, IV	334.84	$z^{4}F^{\circ}_{3\frac{1}{2}}$—$e^{4}F_{2\frac{1}{2}}$		
17.35	1		339.43	$z^{4}G^{\circ}_{2\frac{1}{2}}$—35		
6,506.25	4	6, IV	365.59	$z^{4}D_{\frac{1}{2}}$—33		
6,492.86	4	5, V	397.29			
85.54	20	20, II A	414.66	$a^{2}F_{3\frac{1}{2}}$—$2^{\circ}_{4\frac{1}{2}}$	(0.00) 1.10	(0.00) 1.10
80.20	1		427.37	$a^{2}F_{2\frac{1}{2}}$—$y^{4}D^{\circ}_{1\frac{1}{2}}$		
68.44	10	8, II A	455.42	$b^{2}D_{2\frac{1}{2}}$—$z^{4}S^{\circ}_{1\frac{1}{2}}$		
55.99	250	300, I	485.22	$a^{2}D_{2\frac{1}{2}}$—$z^{2}F^{\circ}_{3\frac{1}{2}}$	(0.00) 1.18	(0.00) 1.15
54.50	150	200, I	488.80	$a^{4}F_{1\frac{1}{2}}$—$z^{4}P^{\circ}_{2\frac{1}{2}}$	(0.38, 1.11) 0.80, 1.54, 2.26	(0.39, 1.18) 0.02, 0.81, 159, 2.38
50.34	6	8, II A	498.78	$a^{2}P_{1\frac{1}{2}}$—$x^{2}D^{\circ}_{2\frac{1}{2}}$	(0.00) 1.29	(0.00) 1.20
49.94	3		499.74			
48.25	4	10?, II A	503.81	$a^{2}D_{1\frac{1}{2}}$—$z^{4}D^{\circ}_{2\frac{1}{2}}$		
48.10	20	50?, II A	504.17	$a^{4}F_{1\frac{1}{2}}$—$y^{2}D^{\circ}_{1\frac{1}{2}}$		
26.60	2		556.04	$z^{4}D^{\circ}_{2\frac{1}{2}}$—$e^{4}F_{3\frac{1}{2}}$		
20.90	1		569.85	$z^{2}F^{\circ}_{3\frac{1}{2}}$—$e^{2}F_{3\frac{1}{2}}$		
17.23	2	3, III? A	578.85	$b^{2}D_{2\frac{1}{2}}$—$x^{2}D^{\circ}_{1\frac{1}{2}}$		
6,410.98	200	300, I	593.94	$a^{4}F_{2\frac{1}{2}}$—$z^{4}G^{\circ}_{3\frac{1}{2}}$	(0.00) 1.09	(0.00) 1.10
6,394.23	400	600, I	634.79	$a^{4}F_{3\frac{1}{2}}$—$z^{4}G^{\circ}_{4\frac{1}{2}}$	(0.00 W) 1.02 A[1]	(0.00) 0.90 A[1]
80.48	1	1, V	668.48			
75.50	2		680.72	$z^{4}F^{\circ}_{4\frac{1}{2}}$—$e^{4}F_{4\frac{1}{2}}$		
75.11	2	2, V	681.68			
60.20	30	30, II	718.44	$a^{2}P_{\frac{1}{2}}$—$x^{2}D^{\circ}_{1\frac{1}{2}}$	(0.00) 0.89	(0.00) 0.93
56.38	3	4, III A	727.88	$b^{2}D_{1\frac{1}{2}}$—$L^{\circ}_{1\frac{1}{2}}$		
53.63	1		734.69	$a^{2}P_{1\frac{1}{2}}$—$x^{2}P^{\circ}_{0\frac{1}{2}}$		
39.16	2	2, III A	770.61	$a^{4}P_{1\frac{1}{2}}$—$z^{2}S^{\circ}_{0\frac{1}{2}}$		
33.74	3	2, IV?	784.10	$z^{4}D^{\circ}_{2\frac{1}{2}}$—$e^{4}D_{3\frac{1}{2}}$		
33.24	2	2, III?	785.35			
30.42	3	2, III A	792.38	$a^{2}F_{2\frac{1}{2}}$—$y^{4}D^{\circ}_{2\frac{1}{2}}$		
25.90	100	150, I	803.67	$a^{2}D_{2\frac{1}{2}}$—$y^{2}F^{\circ}_{2\frac{1}{2}}$	(0.63, 0.99) 0.25, 0.63, 1.01, 1.38, 1.76	(0.19, 0.56, 0.94) 0.27, 0.64, 1.01, 1.39, 1.77
18.26	5	12, III A	822.78	$a^{2}F_{3\frac{1}{2}}$—$w^{2}F^{\circ}_{2\frac{1}{2}}$		
10.13	8	12, IV	843.16			
08.87	2	2, III	846.32			
6,308.21	2	3, III	847.98			
6,293.57	60	80, II A	884.85	$a^{4}F_{3\frac{1}{2}}$—$y^{2}D^{\circ}_{2\frac{1}{2}}$	(0.00) 1.33	(0.00) 1.26
88.56	6	7, III A	897.50	$a^{2}P_{1\frac{1}{2}}$—$y^{4}P^{\circ}_{0\frac{1}{2}}$		
87.73	7	8, III A	899.60	$b^{2}D_{2\frac{1}{2}}$—$x^{4}D^{\circ}_{3\frac{1}{2}}$		
78.31	1		923.46	$a^{2}P_{1\frac{1}{2}}$—$y^{4}P^{\circ}_{1\frac{1}{2}}$		
66.00	40	60, III	954.74	$a^{2}G_{4\frac{1}{2}}$—$z^{2}H^{\circ}_{5\frac{1}{2}}$	(0.00) 1.06	(0.00) 1.06
49.92	300	500, I	15,995.79	$a^{4}F_{4\frac{1}{2}}$—$z^{4}G^{\circ}_{5\frac{1}{2}}$	(0.00) 1.13	(0.00) 1.14
38.58	12	15, III A	16,024.86	$a^{4}P_{2\frac{1}{2}}$—$x^{4}D^{\circ}_{1\frac{1}{2}}$		
36.76	7	10, III A	029.54	$a^{4}P_{\frac{1}{2}}$—$z^{2}S^{\circ}_{0\frac{1}{2}}$		
36.17	8	12, IV	031.06			
34.85	10	15, III A	034.45	$b^{2}D_{2\frac{1}{2}}$—$x^{2}D^{\circ}_{2\frac{1}{2}}$	(0.00) 1.26	(0.09) 1.27
33.51	10	15, III A	037.90	$a^{4}P_{1\frac{1}{2}}$—$x^{4}D^{\circ}_{0\frac{1}{2}}$		
32.56	1		040.34	$z^{4}F^{\circ}_{3\frac{1}{2}}$—$e^{4}F_{3\frac{1}{2}}$		
25.33	2 h		058.97	$a^{4}P_{1\frac{1}{2}}$—$3^{\circ}_{2\frac{1}{2}}$		
24.24	1		061.78	$b^{2}D_{1\frac{1}{2}}$—$v^{2}F^{\circ}_{2\frac{1}{2}}$		
19.46	2	2, V	074.13			
18.19	5	7, III	077.41	$a^{2}G_{4\frac{1}{2}}$—$x^{4}F^{\circ}_{4\frac{1}{2}}$		
14.35	2		087.34	$z^{2}D^{\circ}_{1\frac{1}{2}}$—$e^{2}F_{2\frac{1}{2}}$		
6,206.76	2		107.02			
6,173.74		1, IV A	193.17	$b^{2}D_{1\frac{1}{2}}$—$z^{4}S^{\circ}_{1\frac{1}{2}}$		
67.69	2		209.05	$a^{2}F_{2\frac{1}{2}}$—$1^{\circ}_{3\frac{1}{2}}$		

TABLE 6.—*The arc spectrum of lanthanum (La* I*)*—Continued

λ air I. A.	Intensities, temperature class		ν vac cm⁻¹	Term combination	Zeeman effects	
	B. S.	K. & C.			Observed	Computed
65. 69	30	40, II	214. 31	$a^4P_{1\frac{1}{2}}-x^4D^{\circ}_{1\frac{1}{2}}$	(0. 88) 0. 87, **1. 43**, 1. 99	(0.27, **0. 81**) 0.88, **1. 42**, 1. 96
65. 02	3	2, IV	216. 07			
54. 55	1		243. 66	$z^4F^{\circ}_{2\frac{1}{2}}-e^4F_{1\frac{1}{2}}$		
46. 53	10	5, IV	264. 85	$a^2S_{\frac{1}{2}}-{}^2P_{1\frac{1}{2}}$		
45. 29	3	3, III	268. 13	$z^4F^{\circ}_{3\frac{1}{2}}-e^4D_{3\frac{1}{2}}$		
42. 98	10	10, III	274. 25		(0. 00) 1. 15	
41. 71	3		277. 61			
36. 48	2	2, II A	291. 49	$a^2F_{2\frac{1}{2}}-y^4D^{\circ}_{3\frac{1}{2}}$		
34. 39	20	30, III	297. 04	$a^4P_{\frac{1}{2}}-x^4D^{\circ}_{0\frac{1}{2}}$	(1. 34) 1. 37	(1.35) 1.35
27. 04	8	12, III A	316. 59	$b^2D_{1\frac{1}{2}}-x^2D^{\circ}_{1\frac{1}{2}}$		
23. 75	2	2, IV	325. 36			
21. 27		1, IV	331. 97			
20. 34		1, IV	334. 45	$z^4F_{1\frac{1}{2}}-34$		
11. 71	20	30, II	357. 52	$a^2F_{3\frac{1}{2}}-w^2F_{3\frac{1}{2}}$	(0. 00) 1. 17	(0. 12) 1. 15
08. 47	40	60, II	366. 19	$a^4P_{2\frac{1}{2}}-x^4D^{\circ}_{2\frac{1}{2}}$	(0. 53) 1. 34B	(–, 0. 48, 0.80) –, 1. 06, 1.38, 1. 70, –
6, 107. 26	4	12, II A	369. 43	$a^4F_{2\frac{1}{2}}-y^2D^{\circ}_{2\frac{1}{2}}$		
6, 092. 22	2	1, III A	409. 85	$a^2P_{\frac{1}{2}}-x^2P^{\circ}_{0\frac{1}{2}}$ $z^4D^{\circ}_{1\frac{1}{2}}-e^2F_{2\frac{1}{2}}$		
88. 00	2	1n, IV	421. 22			
84. 86	5	8, III	429. 69	$y^2F^{\circ}_{2\frac{1}{2}}-35$		
75. 24		1, III A	455. 71	$a^2F_{3\frac{1}{2}}-v^2F^{\circ}_{2\frac{1}{2}}$		
74. 01	3	1, III A	459. 04	$b^2D_{2\frac{1}{2}}-y^4P^{\circ}_{1\frac{1}{2}}$		
72. 04	3	4, III A	464. 38	$b^2D_{1\frac{1}{2}}-x^4F^{\circ}_{1\frac{1}{2}}$		
68. 70	20	30, III	473. 44	$a^4P_{\frac{1}{2}}-x^4D^{\circ}_{1\frac{1}{2}}$	(0. 75) **0.40**, 1. 90	(0. 77) **0.38**, 1. 93
44. 8	2	2, III A	538. 6	$b^2D_{1\frac{1}{2}}-x^4F^{\circ}_{2\frac{1}{2}}$		
41. 6	2	2, III	547. 3			
38. 57	20	25, III A	555. 64	$a^4P_{1\frac{1}{2}}-x^4D^{\circ}_{2\frac{1}{2}}$		
34. 5	2 h	3, V	566. 8			
32. 38	5		572. 63	$a^2P_{\frac{1}{2}}-y^4P^{\circ}_{0\frac{1}{2}}$		
31. 46	5	3n, IV?	575. 15			
25. 09	2 p?	1, IV?	592. 68			
17. 16	3	1, III A	614. 54	$z^4F^{\circ}_{1\frac{1}{2}}-e^4F_{1\frac{1}{2}}$		
6, 007. 34	50	50, III A	641. 70	$a^4F_{4\frac{1}{2}}-y^4F^{\circ}_{3\frac{1}{2}}$	(0. 00 w) 1. 77 A^2	(0. 00) 1. 85 A^2
5, 992. 35	3	2, III A	683. 33	$a^4P_{1\frac{1}{2}}-4^{\circ}_{1\frac{1}{2}}$		
82. 34	10	5, III A	711. 25	$a^4F_{1\frac{1}{2}}-y^2D^{\circ}_{2\frac{1}{2}}$		
75. 75	10	3, III A	729. 68	$a^4P_{2\frac{1}{2}}-w^2F^{\circ}_{3\frac{1}{2}}$		
70. 58	HNR	1, III A	744. 16	$a^2D_{2\frac{1}{2}}-z^4P^{\circ}_{1\frac{1}{2}}$		
62. 30	3	1, III	758. 98			
62. 59	4	1, III A	766. 60	$b^2D_{2\frac{1}{2}}-x^2P^{\circ}_{1\frac{1}{2}}$		
60. 59	4	3, III A	772. 23	$b^2D_{1\frac{1}{2}}-x^2D^{\circ}_{2\frac{1}{2}}$		
40. 83	3	1, III A	828. 01	$a^4P_{2\frac{1}{2}}-v^2F^{\circ}_{2\frac{1}{2}}$		
35. 29	20	15, II A	843. 72	$a^4F_{3\frac{1}{2}}-y^4F^{\circ}_{2\frac{1}{2}}$	(0.00 w) 1.72 A^2	(0.00) 1.76 A^2
30. 68	100	400, I	856. 81	$a^2D_{1\frac{1}{2}}-y^2F^{\circ}_{2\frac{1}{2}}$		(0.00) 0.86
30. 61	200		857. 01	$a^2D_{2\frac{1}{2}}-y^2F^{\circ}_{3\frac{1}{2}}$	(0.00) 0.87	(0.26) 1.14
28. 48	5	4, III A	863. 07	$a^2F_{2\frac{1}{2}}-w^2F^{\circ}_{2\frac{1}{2}}$		
17. 64	20	15, II A	893. 96	$a^2D_{2\frac{1}{2}}-z^4G^{\circ}_{2\frac{1}{2}}$	(0.27) 1.10 h	(0.29) 1.13
04. 28	4	2, III A	932. 20	$a^2F_{3\frac{1}{2}}-x^4F^{\circ}_{2\frac{1}{2}}$	(0.00) 1.25	(0.00) 1.16
5, 900. 75	3	1, III A	942. 31	$a^4P_{\frac{1}{2}}-4^{\circ}_{1\frac{1}{2}}$		
5, 894. 84	20	8, III A	16, 959. 30	$a^4P_{2\frac{1}{2}}-z^4S^{\circ}_{1\frac{1}{2}}$		
77. 96	3	1, III A	17, 008. 00	$a^2S_{\frac{1}{2}}-w^2D^{\circ}_{1\frac{1}{2}}$		
77. 62	4	2, III A	008. 98	$a^4F_{2\frac{1}{2}}-y^2P^{\circ}_{1\frac{1}{2}}$		
74. 72	8	8, III A	017. 38	$a^4P_{1\frac{1}{2}}-v^2F^{\circ}_{2\frac{1}{2}}$		
69. 93	2	1, III A	031. 27	$a^2F_{3\frac{1}{2}}-x^4D^{\circ}_{3\frac{1}{2}}$		
57. 44	2		067. 58			
55. 57	20	15, II A	073. 03	$a^4F_{2\frac{1}{2}}-y^4F^{\circ}_{1\frac{1}{2}}$	(0.00 w) 1.42 A^2	(0.00) 1.41 A^2
52. 26	6	2, III A	082. 69	$a^4P_{2\frac{1}{2}}-x^2D^{\circ}_{1\frac{1}{2}}$		
48. 37	15	8, III A	094. 05	$z^4F^{\circ}_{1\frac{1}{2}}-e^4F_{2\frac{1}{2}}$	(0.00) 0.90	
45. 02	10	6, III A	103. 85	$a^2D_{2\frac{1}{2}}-z^4P^{\circ}_{2\frac{1}{2}}$	(0.00) 1.18	(0.00) 1.20
39. 77	3	2, II A	119. 23	$a^2D_{2\frac{1}{2}}-y^2D^{\circ}_{1\frac{1}{2}}$		
29. 71	20	10, III A	148. 77	$a^4P_{1\frac{1}{2}}-z^4S^{\circ}_{1\frac{1}{2}}$	(0. 00) 1. 75	(0. 17) 1. 75
27. 56	8	3, III A	155. 10	$b^2D_{2\frac{1}{2}}-y^4P^{\circ}_{2\frac{1}{2}}$	(0.59) 1.50 ?	(0.55) 1.42

TABLE 6.—*The arc spectrum of lanthanum (La I)*—Continued

λ_{air} I. A.	Intensities, temperature class		ν_{vac} cm^{-1}	Term combination	Zeeman effects	
	B. S.	K. & C.			Observed	Computed
23. 82	15	10, III A	166. 11	$a^{2}F_{3\frac{1}{2}}$—$x^{2}D^{\circ}_{2\frac{1}{2}}$	(0.00 w) 0.96 h	(0.00) 0.98
21. 98	30	30, III	171. 54	$a^{2}G_{3\frac{1}{2}}$—$y^{2}G^{\circ}_{3\frac{1}{2}}$	(0.00) 0.93	(0.12) 0.93
13. 44	2	1, III A	196. 76	$b^{2}D_{1\frac{1}{2}}$—$y^{4}P^{\circ}_{1\frac{1}{2}}$		
5, 802. 10	2	1, III A	230. 37	$a^{4}P^{\circ}_{2\frac{1}{2}}$—$x^{4}F^{\circ}_{1\frac{1}{2}}$		
5, 791. 32	200	400, I	262. 45	$a^{4}F_{4\frac{1}{2}}$—$y^{4}F^{\circ}_{4\frac{1}{2}}$	(0. 00 w) 1. 31 B	(0. 18) 1. 30
89. 22	150	250, I	268. 71	$a^{4}F_{3\frac{1}{2}}$—$y^{4}F^{\circ}_{3\frac{1}{2}}$	(0. 15) 1. 21	(0. 12) 1. 20
69. 97	25	25, III A	326. 32	$a^{2}F_{3\frac{1}{2}}$—$v^{2}F^{\circ}_{3\frac{1}{2}}$		
69. 32	80	80, I	328. 27	$a^{4}F_{2\frac{1}{2}}$—$y^{4}F^{\circ}_{2\frac{1}{2}}$	(0. 00) 1. 01	(0. 04) 1. 02
61. 83	50	60, I	350. 80	$a^{4}F_{1\frac{1}{2}}$—$y^{2}P^{\circ}_{1\frac{1}{2}}$	(0. 94) 0. 00, 0. 68, 1. 34	(0. 32, 0. 96) 0. 09, 0. 73, 1. 37
44. 41	60	80, III	403. 41	$a^{4}P_{2\frac{1}{2}}$—$x^{4}D^{\circ}_{3\frac{1}{2}}$	(0. 00 w) 1. 24	(0. 00) 1. 25
42. 93	4	2, III A	407. 90	$a^{4}P_{\frac{1}{2}}$—$z^{4}S^{\circ}_{1\frac{1}{2}}$		
40. 65	80	100, I	414. 81	$a^{4}F_{1\frac{1}{2}}$—$y^{4}F^{\circ}_{1\frac{1}{2}}$	(0. 47) 0. 59 B	(0. 18, 0. 55) 0. 33, 0. 60, 0. 96
34. 93	6	5, III A	432. 18	$a^{2}G_{3\frac{1}{2}}$—$u^{2}F^{\circ}_{2\frac{1}{2}}$	(0. 00) 0. 92	(0. 00) 0. 92
20. 01	10	10, III A	477. 65	$a^{4}F_{3\frac{1}{2}}$—$x^{2}F^{\circ}_{2\frac{1}{2}}$	(0. 16, 0. 48, 0. 81) 1. 93 A^2	(0. 16, 0. 48, 0. 80) 1. 70, 2. 03
14. 55		1, III A	494. 35	$a^{2}G_{3\frac{1}{2}}$—$y^{4}G^{\circ}_{3\frac{1}{2}}$		
14. 01	4	5, III A	496. 00	$a^{2}F_{2\frac{1}{2}}$—$v^{2}F^{\circ}_{2\frac{1}{2}}$	(0. 62) ?	(0. 66) 1. 05
10. 85	2 p ?	2, III	505. 68	$a^{2}P_{1\frac{1}{2}}$—$w^{2}P^{\circ}_{1\frac{1}{2}}$		
03. 32	20	10, III	528. 80	$a^{4}F_{1\frac{1}{2}}$—$y^{2}P^{\circ}_{1\frac{1}{2}}$		
02. 57		2, III	531. 10	$a^{4}P_{1\frac{1}{2}}$—$x^{2}D^{\circ}_{1\frac{1}{2}}$		
5, 701. 15		1, III	535. 47	$a^{2}G_{4\frac{1}{2}}$—$y^{4}G^{\circ}_{3\frac{1}{2}}$		
5, 699. 32	3	5, III	541. 10	$a^{4}F_{4\frac{1}{2}}$—$x^{2}F^{\circ}_{3\frac{1}{2}}$		
96. 18	30	40, I	550. 77	$a^{2}D_{2\frac{1}{2}}$—$z^{4}G^{\circ}_{3\frac{1}{2}}$	(0.00 w) 0.80 A^1	(0.00) 0.70 A^1
61. 34	2	1, III A	658. 78	$a^{2}G_{3\frac{1}{2}}$—$y^{2}G^{\circ}_{4\frac{1}{2}}$		
57. 71	30	50, II	670. 10	$a^{4}F_{1\frac{1}{2}}$—$y^{4}F^{\circ}_{2\frac{1}{2}}$	(0.29, 0.88) 0.73, 1.33, 1. 94	(0. 29, 0.89) 0.12, 0.71, 1.30, 1. 90
56. 54	2	1, III A	673. 76	$a^{2}P_{1\frac{1}{2}}$—$u^{2}F^{\circ}_{2\frac{1}{2}}$		
54. 8	20	3, III A	679. 2	$a^{4}P_{\frac{1}{2}}$—$x^{4}F^{\circ}_{1\frac{1}{2}}$		
48. 24	50	80, III	699. 73	$a^{2}G_{4\frac{1}{2}}$—$y^{2}G^{\circ}_{4\frac{1}{2}}$	(0.00) 1.12	(0.00) 1.12
39. 31	8	5, III A	727. 76	$a^{4}P_{1\frac{1}{2}}$—$x^{2}D^{\circ}_{2\frac{1}{2}}$		
32. 02	15	25, II	750. 70	$a^{2}F_{2\frac{1}{2}}$—$x^{2}D^{\circ}_{1\frac{1}{2}}$	(0.00) 0.93	(0.00) 0.92
5, 631. 22	60	100, I	753. 22	$a^{4}F_{2\frac{1}{2}}$—$y^{4}F^{\circ}_{3\frac{1}{2}}$	(0.00 W) 1.45 A^2	(0.00) 1.55 A^2
5, 598. 52	3		856. 92		(0.00) 0.49	
88. 33	100	20, II	889. 48	$a^{4}F_{3\frac{1}{2}}$—$y^{4}F^{\circ}_{4\frac{1}{2}}$		
70. 37	3	5, II A	947. 16	$a^{2}D_{1\frac{1}{2}}$—$z^{4}G^{\circ}_{2\frac{1}{2}}$		
68. 45	30	50, II	953. 35	$a^{4}F_{3\frac{1}{2}}$—$z^{2}G^{\circ}_{3\frac{1}{2}}$	(0.44) 1.16	(0.41) 1.15
65. 70	10	20, II	962. 22	$a^{4}F_{2\frac{1}{2}}$—$x^{2}F^{\circ}_{2\frac{1}{2}}$		
65. 43	10	20, III	963. 09	$a^{4}P_{2\frac{1}{2}}$—$y^{4}P^{\circ}_{1\frac{1}{2}}$	(0.00) 1.52	(0.00) 1.49
62. 54	2	2, III	17, 972. 42	$a^{2}F_{2\frac{1}{2}}$—$x^{4}F^{\circ}_{2\frac{1}{2}}$		
44. 90	3	6, III	18, 029. 60	$a^{2}P_{1\frac{1}{2}}$—$Sf^{\circ}_{1\frac{1}{2}}$	(0.28) 1.47	(0.35) 1.44
41. 25	15	20, III	041. 47	$b^{2}D_{2\frac{1}{2}}$—$w^{2}P^{\circ}_{1\frac{1}{2}}$	(0.00) 1.25	(0.00) 1.25
32. 17	4	3, III	071. 08	$a^{2}F_{2\frac{1}{2}}$—$x^{4}D^{\circ}_{3\frac{1}{2}}$		
29. 86	2	3, III	078. 63	$a^{2}G_{3\frac{1}{2}}$—$u^{2}F^{\circ}_{3\frac{1}{2}}$		
26. 51		1, V	089. 59	$z^{2}F^{\circ}_{2\frac{1}{2}}$—35		
17. 34	20	30, III	119. 66	$a^{2}G_{4\frac{1}{2}}$—$u^{2}F^{\circ}_{3\frac{1}{2}}$	(0.00) 1.10	(0.00) 1.10
15. 28	5	10, III	126. 42	$a^{4}P_{1\frac{1}{2}}$—$y^{4}P^{\circ}_{0\frac{1}{2}}$	(0.25) 1.42	(0.30) 1. 39, 2.00
07. 33		2, III	152. 59	$a^{4}P_{1\frac{1}{2}}$—$y^{4}P^{\circ}_{1\frac{1}{2}}$		
06. 00	20	40, II	156. 97	$a^{2}D_{1\frac{1}{2}}$—$z^{4}P^{\circ}_{2\frac{1}{2}}$	(0.00 w) 1.54 h	(0.00) 1.50
03. 80	40	80, III	164. 23	$a^{4}F_{4\frac{1}{2}}$—$z^{2}G^{\circ}_{4\frac{1}{2}}$	(0.70) 1.22 B	(0.69) 1.23
02. 66	5	10, III	168. 00	$a^{4}F_{3\frac{1}{2}}$—$x^{2}F^{\circ}_{3\frac{1}{2}}$		
02. 24	3	4, III	169. 38	$a^{2}G_{4\frac{1}{2}}$—$y^{4}G^{\circ}_{4\frac{1}{2}}$		
5, 510. 34	200	300, I	172. 35	$a^{2}D_{1\frac{1}{2}}$—$y^{2}D^{\circ}_{1\frac{1}{2}}$	(0.00) 0. 80	(0. 06) 0. 81
5, 498. 70	2	2n, III	181. 08	$a^{2}P_{\frac{1}{2}}$—$w^{2}P^{\circ}_{1\frac{1}{2}}$		
91. 07	5	8, III	206. 34	$a^{2}F_{2\frac{1}{2}}$—$x^{2}D^{\circ}_{2\frac{1}{2}}$		
75. 17	10	15, III	259. 21		(0. 00) 1. 08	
66. 91	2	3, III	286. 80	$a^{2}F_{3\frac{1}{2}}$—$y^{4}P^{\circ}_{2\frac{1}{2}}$		
55. 14	200	400, I	326. 25	$a^{2}D_{2\frac{1}{2}}$—$y^{2}D^{\circ}_{1\frac{1}{2}}$	(0. 00) 1. 20	(0. 02) 1. 20
37. 55	2	5, III	385. 54	$a^{4}P_{\frac{1}{2}}$—$y^{4}P^{\circ}_{0\frac{1}{2}}$	(0. 00) 2. 54	(0. 21) 2. 50
29. 86	6	15, III	411. 57	$a^{4}P_{\frac{1}{2}}$—$y^{4}P^{\circ}_{1\frac{1}{2}}$	(0. 49) 1. 04	(0. 55) 1. 06, 2. 15
22. 10		3, III A	437. 93	$a^{4}F_{2\frac{1}{2}}$—$z^{2}G^{\circ}_{3\frac{1}{2}}$		
5, 415. 67	4	8, III	459. 82	$a^{4}P_{1\frac{1}{2}}$—$x^{4}P^{\circ}_{1\frac{1}{2}}$	(0. 36) 1. 56 w	(0. 39) 1. 56
5, 390. 63	?		545. 56	$a^{2}G_{3\frac{1}{2}}$—$w^{2}D^{\circ}_{2\frac{1}{2}}$		

TABLE 6.—*The arc spectrum of lanthanum (La I)*—Continued

λ_{air} I. A.	Intensities, temperature class		ν_{vac} cm^{-1}	Term combination	Zeeman effects	
	B. S.	K. & C.			Observed	Computed
80.00	3	5, III	582.21	$a^2G_{3\frac{1}{2}}-t^2F^{\circ}_{3\frac{1}{2}}$		
65.87	4	8, III	631.14	$a^2F_{2\frac{1}{2}}-y^4P^{\circ}_{1\frac{1}{2}}$		
59.70	2	2, III A	652.59	$a^4F_{2\frac{1}{2}}-x^2F^{\circ}_{3\frac{1}{2}}$		
57.85	25	60, III	659.03	$a^4P_{2\frac{1}{2}}-y^4P^{\circ}_{2\frac{1}{2}}$	(0.00) 1.53	(0.00) 1.54
30.64	1		754.27			
23.56	3	3, III	779.22	$b^2D_{1\frac{1}{2}}-w^2P^{\circ}_{1\frac{1}{2}}$		
21.34	1		787.04	$a^2P_{1\frac{1}{2}}-w^2D^{\circ}_{2\frac{1}{2}}$		
20.14	3	3, III	791.28	$a^4F_{3\frac{1}{2}}-z^2G^{\circ}_{4\frac{1}{2}}$		
07.52	3	3, III	835.96			
5,304.01	20	30, III	848.43	$a^4P_{1\frac{1}{2}}-y^4P^{\circ}_{2\frac{1}{2}}$		
5,287.45	1	1, V	907.46			
76.40	5	10, III	947.06	$b^2D_{1\frac{1}{2}}-w^2F^{\circ}_{2\frac{1}{2}}$	(0.00) 0.90	(0.00) 0.90.
71.18	100	150, I	18,965.82	$a^2D_{2\frac{1}{2}}-y^2P^{\circ}_{1\frac{1}{2}}$	(0.00) 1.39 A^2	(0.00) 1.44 A^2
57.83	4	3, III	19,013.98		(0.00) 1.07	
53.45	100	100, I	029.83	$a^2D_{2\frac{1}{2}}-y^4F^{\circ}_{1\frac{1}{2}}$	(0.23, 0.69) 0.57, 1.03, 1.49, 1.95	(0.21, 0.63) 0.57, 0.99 1.41, 1.83.
40.81	4	2, III	075.72			
39.54	4	4, III	080.35	$a^2F_{3\frac{1}{2}}-y^2G^{\circ}_{3\frac{1}{2}}$		
34.27	150	300, II	099.56	$a^4F_{4\frac{1}{2}}-1^{\circ}_{3\frac{1}{2}}$	(0.00 W) 2.10 A^2	(0.00) 2.10 A^2.
5,211.85	150	300, II	187.72	$a^4F_{4\frac{1}{2}}-y^4D^{\circ}_{3\frac{1}{2}}$	(0.00 W) 1.73 A^2	(0.00) 1.71 A^2.
5,190.34	8		261.21			
83.91	10	20, II	285.10	$a^2D_{2\frac{1}{2}}-y^4F^{\circ}_{2\frac{1}{2}}$		
79.11	2	2, III	302.98	$b^2D_{1\frac{1}{2}}-5^{\circ}_{1\frac{1}{2}}$		
77.30	150	300, II	309.72	$a^4F_{3\frac{1}{2}}-y^4D^{\circ}_{2\frac{1}{2}}$	(0.00) 1.07	(0.00) 1.06.
68.95	2		340.92	$a^2F_{3\frac{1}{2}}-u^2F^{\circ}_{2\frac{1}{2}}$		
67.79	20	20, III	345.26	$a^4F_{4\frac{1}{2}}-2^{\circ}_{4\frac{1}{2}}$		
64.03		1, V?	359.34	$b^2D_{2\frac{1}{2}}-t^2F^{\circ}_{3\frac{1}{2}}$		
61.54	2		368.68			
58.68	40	80, I	379.42	$a^2D_{1\frac{1}{2}}-y^2D^{\circ}_{2\frac{1}{2}}$	(0.19, 0.57) 1.05, 1.45, 1.85	(0.20, 0.60) —, 0.98, 1.38, 1.78
52.31	1		403.38	$a^2F_{3\frac{1}{2}}-y^4G^{\circ}_{3\frac{1}{2}}$		
45.42	100	200, II	429.36	$a^4F_{2\frac{1}{2}}-y^4D^{\circ}_{1\frac{1}{2}}$	(0.00) 0.89	(0.00) 0.90)
39.16	3		453.03			
35.42	3	2, V	467.20			
34.37	2		471.18			
29.81	3		488.48			
20.87	10	10, III	522.51	$b^2D_{1\frac{1}{2}}-w^2D^{\circ}_{1\frac{1}{2}}$	(0.00) 0.92	(0.03) 0.90
09.12	3	2, III A	567.40	$a^2F_{3\frac{1}{2}}-y^2G^{\circ}_{4\frac{1}{2}}$		
06.23	100	150, II	578.48	$a^4F_{1\frac{1}{2}}-y^4D^{\circ}_{0\frac{1}{2}}$	(0.19) 0.62 A^2?	(0.19) 0.22, 0.60
5,103.11	3	2, III	590.45			
5,096.59	2	1, IV?	615.51			
86.22	2		655.50	$z^4F^{\circ}_{2\frac{1}{2}}-35$		
79.37	4	5, IV	682.01			
78.92	3	2, V?	683.76			
72.10	3	1, III A	710.22	$a^2D_{2\frac{1}{2}}-y^4F^{\circ}_{3\frac{1}{2}}$		
67.90	15	15, III	726.56	$a^4F_{3\frac{1}{2}}-1^{\circ}_{3\frac{1}{2}}$		
56.46	60	80, II	771.18	$a^4F_{1\frac{1}{2}}-y^4D^{\circ}_{1\frac{1}{2}}$	(1.20) 0.00, 0.79, 1.57	(0.39, 1.19) 0.02, 0.81, 1.60
52.10	1		788.25	$b^2D_{2\frac{1}{2}}-v^2D^{\circ}_{1\frac{1}{2}}$		
50.57	60	80, II	794.24	$a^4F_{2\frac{1}{2}}-y^4D^{\circ}_{2\frac{1}{2}}$	(0.80) 1.18 B	(–, –, 0.79) —, 0.88, 1.19, 1.51, —
46.87	30	60, III	808.75	$a^4F_{3\frac{1}{2}}-y^4D^{\circ}_{3\frac{1}{2}}$	(0.00 w) 1.24	(0.00) 1.22
37.60	2		845.20	$a^2P_{1\frac{1}{2}}-6^{\circ}_{0\frac{1}{2}}$		
33.24	2		862.40			
19.50	10	8, III	916.76			
5,001.78	20	10, III A	19,987.32	$a^2F_{3\frac{1}{2}}-w^2F^{\circ}_{3\frac{1}{2}}$		
4,995.95	1		20,010.64	$a^2F_{2\frac{1}{2}}-y^4G^{\circ}_{2\frac{1}{2}}$		
94.64	2	1, III A	015.90	$b^2D_{2\frac{1}{2}}-w^4D^{\circ}_{1\frac{1}{2}}$		
93.87	15	20, II	018.98	$a^2D_{1\frac{1}{2}}-y^2P^{\circ}_{1\frac{1}{2}}$		
84.92	3	2, IV?	054.92	$a^4F_{3\frac{1}{2}}-3^{\circ}_{2\frac{1}{2}}$		
84.63	1		056.09	$a^2P_{1\frac{1}{2}}-v^2D^{\circ}_{2\frac{1}{2}}$		
83.56	2		060.40	$b^2D_{1\frac{1}{2}}-w^2D^{\circ}_{2\frac{1}{2}}$		
77.95	8	8, II A	083.01	$a^2D_{1\frac{1}{2}}-y^4F^{\circ}_{1\frac{1}{2}}$		
68.59	4 d	$2\left\{\begin{matrix}\text{III A}\\ \text{V}\end{matrix}\right\}$	120.84	$a^2F_{2\frac{1}{2}}-y^2G^{\circ}_{3}$		

TABLE 6.—*The arc spectrum of lanthanum (La I)*—Continued

λ_{air} I. A.	Intensities, temperature class		ν_{vac} cm^{-1}	Term combination	Zeeman effects	
	B. S.	K. & C.			Observed	Computed
64.84	3	4, III A	136.03	$a^4F_{1\frac{1}{2}}-y^4D^{\circ}_{2\frac{1}{2}}$		
57.77	4		164.75			
49.76	50	200, I	197.38	$a^2D_{1\frac{1}{2}}-y^2P^{\circ}_{1\frac{1}{2}}$	(0.00) 0.84	(0.00) 0.84
45.84	3	5, III A	213.39	$a^2F_{2\frac{1}{2}}-w^2P^{\circ}_{1\frac{1}{2}}$		
25.40	3	2, IV	297.27			
16.62	3	1, III? A	333.52			
05.13	4	4, III A	381.15	$a^2F_{2\frac{1}{2}}-u^2F^{\circ}_{2\frac{1}{2}}$		
4,901.87	15	25, I	394.70	$a^2D_{2\frac{1}{2}}-z^2G^{\circ}_{3\frac{1}{2}}$	(0.00) 0.94	(0.00) 0.92
4,894.24	2	1, III	426.49			
87.60	4	5, III	454.24	$a^2F_{3\frac{1}{2}}-w^2D^{\circ}_{2\frac{1}{2}}$		
86.82	3	2, IV	457.51			
81.94	1		477.96	$a^4P_{1\frac{1}{2}}-w^2D^{\circ}_{1\frac{1}{2}}$		
78.86	10	15, III	490.89	$a^2F_{3\frac{1}{2}}-t^2F^{\circ}_{3\frac{1}{2}}$	(0.00) 1.10 R	(0.18) 1.10
70.56	5	5, III	525.81	$b^2D_{1\frac{1}{2}}-v^2D^{\circ}_{1\frac{1}{2}}$		
68.90	3	2, IV?	532.80			
67.37	3		539.26	$a^4F_{2\frac{1}{2}}-3^{\circ}_{2\frac{1}{2}}$		
54.95	8	8, III	591.80	$b^2D_{2\frac{1}{2}}-v^2D^{\circ}_{2\frac{1}{2}}$	(0.00) 1.21 R	(0.35) 1.21
50.81	20	20, I	609.37	$a^2D_{2\frac{1}{2}}-x^2F^{\circ}_{3\frac{1}{2}}$		
39.51	20	25, II	657.49	$a^2F_{2\frac{1}{2}}-t^2F^{\circ}_{2\frac{1}{2}}$	(0.00) 0.89	(0.04) 0.89
17.55	3		751.66			
17.17	10	4, IV?	753.29	$b^2D_{2\frac{1}{2}}-7^{\circ}_{1\frac{1}{2}}$		
4,800.24	9	8, III	826.49	$a^4P_{2\frac{1}{2}}-w^2D^{\circ}_{2\frac{1}{2}}$		
4,799.99	8	8, III	827.57	$a^2G_{3\frac{1}{2}}-s^2F^{\circ}_{2\frac{1}{2}}$		
92.46	1	tr, III A	860.30	$a^4F_{1\frac{1}{2}}-x^4D^{\circ}_{0\frac{1}{2}}$		
91.77	1		863.30	$a^4P_{2\frac{1}{2}}-t^2F^{\circ}_{3\frac{1}{2}}$		
91.39	5	5, II	864.96	$a^4F_{2\frac{1}{2}}-w^2F^{\circ}_{2\frac{1}{2}}$		
79.89	4	4, II	915.16	$a^4F_{3\frac{1}{2}}-w^2F^{\circ}_{3\frac{1}{2}}$		
75.14	3	2, V	935.96	$a^2G_{3\frac{1}{2}}-9^{\circ}_{2\frac{1}{2}}$		
70.43	10	15, II	956.63	$a^2F_{2\frac{1}{2}}-w^2D^{\circ}_{1\frac{1}{2}}$	(0.00) 0.93 R	(0.00) 0.89
67.80	1 h		968.19	$a^4F_{4\frac{1}{2}}-z^2H^{\circ}_{4\frac{1}{2}}$		
66.89	60	100, I	20,972.19	$a^2D_{1\frac{1}{2}}-x^2F^{\circ}_{2\frac{1}{2}}$	(0.00) 0.99	(0.00) 0.98
59.71	2	2, IV?	21,003.83	$a^2G_{3\frac{1}{2}}-s^2F^{\circ}_{3\frac{1}{2}}$		
57.14	3	2, IV	015.18			
56.97		1, V	015.93	$a^4P_{1\frac{1}{2}}-w^2D^{\circ}_{2\frac{1}{2}}$		
53.11	2	1, IV	032.99			
52.41	3	3, III	036.09	$a^4F_{2\frac{1}{2}}-x^4D^{\circ}_{2\frac{1}{2}}$		
50.41	10	15, III	044.95	$a^2G_{4\frac{1}{2}}-s^2F^{\circ}_{3\frac{1}{2}}$	(0.00) 1.04 R	(0.00) 1.02
33.82	8	4, V?	118.70	$b^2D_{1\frac{1}{2}}-6^{\circ}_{0\frac{1}{2}}$		
29.09	1	1, V	139.82			
23.72	2	3, II	163.85	$a^4F_{2\frac{1}{2}}-4^{\circ}_{1\frac{1}{2}}$		
14.14	4	5, I	206.86	$a^4F_{1\frac{1}{2}}-w^2F^{\circ}_{2\frac{1}{2}}$		
08.18	8	8, III?	233.71	$b^2D_{2\frac{1}{2}}-8^{\circ}_{1\frac{1}{2}}$	(0.00) 0.97 R	(0.00) 1.15
02.64	8	10, I	258.72	$a^4F_{4\frac{1}{2}}-x^4F^{\circ}_{3\frac{1}{2}}$		
4,700.26	8	8, III?	269.48			
4,695.30	3		291.95	$a^4P_{2\frac{1}{2}}-v^2D^{\circ}_{1\frac{1}{2}}$		
60.70	8	8, III	450.02	$a^2F_{3\frac{1}{2}}-w^4D^{\circ}_{2\frac{1}{2}}$	(0.00) 0.92 R	(0.00) 0.92
53.90	4		481.36	$a^4P_{1\frac{1}{2}}-v^2D^{\circ}_{1\frac{1}{2}}$		
52.07	15	20, I	489.81	$a^4F_{3\frac{1}{2}}-x^4F^{\circ}_{2\frac{1}{2}}$		
50.32	12	15, I	497.90	$a^4F_{2\frac{1}{2}}-v^2F^{\circ}_{2\frac{1}{2}}$	(0.30) 1.13	(0.37) 1.12
48.64	30	40, I	505.67	$a^4F_{1\frac{1}{2}}-4^{\circ}_{1\frac{1}{2}}$	(0.48)	(0.15, 0.46) 0.26, 0.57, 0.87
46.33	10	12, III	516.36	$a^2G_{3\frac{1}{2}}-r^2F^{\circ}_{2\frac{1}{2}}$	(0.00) 0.89 R	(0.00) 0.95
43.11	5	5, III	531.28	$a^2F_{2\frac{1}{2}}-t^2F^{\circ}_{3\frac{1}{2}}$		
27.35	2		604.61	$b^2D_{2\frac{1}{2}}-s^2F^{\circ}_{2\frac{1}{2}}$		
15.06	8	15, III	662.14	$a^4P_{\frac{1}{2}}-w^4D^{\circ}_{0\frac{1}{2}}$	(1.31) 1.37 R	(1.35) 1.35
05.08	6	10, III	709.09	$a^4P_{1\frac{1}{2}}-w^4D^{\circ}_{1\frac{1}{2}}$		
04.24	6	10, III	713.05	$b^2D_{2\frac{1}{2}}-9^{\circ}_{2\frac{1}{2}}$		
4,602.04	10	20, III	723.43	$a^2F_{3\frac{1}{2}}-v^2D^{\circ}_{2\frac{1}{2}}$		
4,596.19	6	10, I	751.08	$a^2D_{2\frac{1}{2}}-y^4D^{\circ}_{2\frac{1}{2}}$		
89.89	5		780.93	$b^2D_{2\frac{1}{2}}-s^2F^{\circ}_{3\frac{1}{2}}$		
81.20	10	12, III	822.25	$a^4P_{2\frac{1}{2}}-w^4D^{\circ}_{2\frac{1}{2}}$		
70.02	60	250, I	875.63	$a^4F_{4\frac{1}{2}}-x^4F^{\circ}_{4\frac{1}{2}}$	(0.00) 1.34	(0.11) 1.34
67.90	50	200, I	885.78	$a^4F_{3\frac{1}{2}}-x^4F^{\circ}_{3\frac{1}{2}}$	(0.00) 1.24	(0.02) 1.23
64.85	6	12, III	900.41	$a^4F_{2\frac{1}{2}}-x^4F^{\circ}_{1\frac{1}{2}}$	(0.00) 1.42 R	(0.15, 0.45) 1.18, 1.48
52.47	8	8, II A	959.96	$a^2F_{2\frac{1}{2}}-v^2D^{\circ}_{1\frac{1}{2}}$	(0.00) 0.87	(0.00) 0.87
50.76	8	10, III A	968.21	$a^4P_{\frac{1}{2}}-w^4D^{\circ}_{1\frac{1}{2}}$	(0.78) 0.38 R	(0.77) 0.38, 1.93

TABLE 6.—*The arc spectrum of lanthanum* (*La* I)—Continued

λ_{air} I. A.	Intensities, temperature class		ν_{vac} cm^{-1}	Term combination	Zeeman effects	
	B. S.	K. & C.			Observed	Computed
50. 16	4	5, III A	971. 11	$a^4F_{1\frac{1}{2}}-z^4S^{\circ}_{1\frac{1}{2}}$		
49. 50	40	50, I	21, 974. 30	$a^4F_{2\frac{1}{2}}-x^4F^{\circ}_{2\frac{1}{2}}$	(0. 00) 1. 08	(0. 17) 1. 07
41. 78	10	15, III	22, 011. 65	$a^4P_{1\frac{1}{2}}-w^4D^{\circ}_{2\frac{1}{2}}$		
37. 57	2		032. 07	$a^2P_{1\frac{1}{2}}-u^2D^{\circ}_{1\frac{1}{2}}$		
28. 88	3		074. 34	$a^4P_{1\frac{1}{2}}-6^{\circ}_{0\frac{1}{2}}$		
07. 4	2		179. 5	$a^2G_{3\frac{1}{2}}-r^2F^{\circ}_{3\frac{1}{2}}$		
01. 57	6	10, II A	208. 26	$a^4F_{2\frac{1}{2}}-x^2D^{\circ}_{2\frac{1}{2}}$		
4, 500. 21	30	40, II	214. 97	$a^4P_{2\frac{1}{2}}-w^4D^{\circ}_{3\frac{1}{2}}$	(0. 00 w) 1. 10 A[1]	(0. 12, 0. 37–) 0. 67, 0. 92, 1. 17–, –, –
4, 499. 04	10	10, III	220. 75	$a^2G_{4\frac{1}{2}}-r^2F^{\circ}_{3\frac{1}{2}}$	(0. 00) 1. 02	(0. 00) 1. 02
94. 71	20	30, I	242. 16	$a^4F_{1\frac{1}{2}}-x^4F^{\circ}_{1\frac{1}{2}}$	(0. 51) 0. 27, 0. 58, 0. 91 us	(0. 16, 0. 47) 0. 26, 0. 57, 0. 88
93. 81	5	10, I A	246. 61	$a^2D_{1\frac{1}{2}}-y^4D^{\circ}_{0\frac{1}{2}}$	(0. 00) 0. 72 R	(0. 38) 0. 42, 1. 17
93. 11	15	25, I	250. 08	$a^2D_{2\frac{1}{2}}-y^4D^{\circ}_{3\frac{1}{2}}$	(0. 00) 1. 16	(0. 04) 1. 21
91. 76	10	15, III	256. 76	$a^4P_{2\frac{1}{2}}-7^{\circ}_{1\frac{1}{2}}$	(0. 00) 1. 52	(0. 00) 1. 54
86. 06	10	20, III	285. 04	$a^4P_{1\frac{1}{2}}-v^2D^{\circ}_{2\frac{1}{2}}$		
79. 82	6	15, II A	316. 08	$a^4F_{1\frac{1}{2}}-x^4F^{\circ}_{2\frac{1}{2}}$		
74. 54	4	5, III A	342. 42	$b^2D_{1\frac{1}{2}}-s^2F^{\circ}_{2\frac{1}{2}}$		
68. 97	10	25, II	370. 26	$a^4F_{2\frac{1}{2}}-x^4F^{\circ}_{3\frac{1}{2}}$		
55. 21	3	10, II A	439. 35	$a^2D_{1\frac{1}{2}}-y^4D^{\circ}_{1\frac{1}{2}}$		
53. 85		2, IV A	446. 20	$a^4P_{1\frac{1}{2}}-7^{\circ}_{1\frac{1}{2}}$		
52. 15	15	30, II	449. 78	$a^2G_{3\frac{1}{2}}-y^2H^{\circ}_{4\frac{1}{2}}$	(0.00) 0.98	(0.00) 0.97
45. 12	2	2, III A	490. 29	$a^2F_{2\frac{1}{2}}-w^4D^{\circ}_{2\frac{1}{2}}$		
43. 94	5	10, I	496. 26	$a^2D_{2\frac{1}{2}}-3^{\circ}_{2\frac{1}{2}}$		
42. 68	6	12, II	502. 64	$a^4F_{3\frac{1}{2}}-x^4F^{\circ}_{4\frac{1}{2}}$		
23. 90	20	30, II	598. 16	$a^2G_{4\frac{1}{2}}-y^2H^{\circ}_{5\frac{1}{2}}$	(0.00) 1.09	(0.00) 1.09
17. 14	2	6n, III	632. 75	$a^4F_{2\frac{1}{2}}-y^4P^{\circ}_{1\frac{1}{2}}$		
13. 45		2, III A	651. 67	$a^2D_{2\frac{1}{2}}-x^4D^{\circ}_{1\frac{1}{2}}$		
03. 02	2	8, III A	705. 33	$a^4P_{\frac{1}{2}}-7^{\circ}_{1\frac{1}{2}}$		
4, 402. 64	5	15, III	707. 29	$a^2P_{\frac{1}{2}}-u^2D^{\circ}_{1\frac{1}{2}}$	(0.00) 0.86	(0.00) 0.86
4, 397. 04		2, IV A	736. 21	$a^2F_{3\frac{1}{2}}-s^2F^{\circ}_{2\frac{1}{2}}$		
96. 79		4, IV A	737. 50	$a^4P_{2\frac{1}{2}}-8^{\circ}_{1\frac{1}{2}}$		
96. 31		2, IV	739. 98			
93. 52	2	4, III	754. 42			
89. 87	6	15, III	773. 34	$a^2P_{1\frac{1}{2}}-u^2D^{\circ}_{2\frac{1}{2}}$	(0.00) 1.07	(0.00) 1.06
80. 55	4	12, II A	821. 79	$a^2D_{2\frac{1}{2}}-w^2F^{\circ}_{2\frac{1}{2}}$		
60. 86	2	2, III A	924. 84	$a^2F_{2\frac{1}{2}}-7^{\circ}_{1\frac{1}{2}}$		
60. 49	2	2, III A	926. 78	$a^4P_{1\frac{1}{2}}-8^{\circ}_{1\frac{1}{2}}$		
57. 88	2	2, III A	940. 51	$a^4F_{2\frac{1}{2}}-x^2P^{\circ}_{1\frac{1}{2}}$		
54. 79	20	25, III	22, 956. 79	$b^2D_{1\frac{1}{2}}-r^2F^{\circ}_{2\frac{1}{2}}$		
40. 72	10	15, III	23, 031. 20	$b^2D_{1\frac{1}{2}}-r^2F^{\circ}_{2\frac{1}{2}}$	(0.00) 0.90	(0.00) 0.87
39. 93	5	6, III A	035. 39			
26. 19	2		108. 55	$a^4P_{2\frac{1}{2}}-s^2F^{\circ}_{2\frac{1}{2}}$		
11. 73	5	4, III A	186. 05	$a^4P_{\frac{1}{2}}-8^{\circ}_{1\frac{1}{2}}$	(0.59) 0.96 R	(0.58) 0.96, 2.12
06. 00	6	6, II A	216. 90	$a^4P_{2\frac{1}{2}}-9^{\circ}_{2\frac{1}{2}}$	(0. 14) 1. 49	(0. 20) 1. 50
4, 300. 62	HNR	3	245. 94	$a^2P_{\frac{1}{2}}-v^2P^{\circ}_{0\frac{1}{2}}$		
4, 291. 00	2		298. 06	$a^4P_{1\frac{1}{2}}-s^2F^{\circ}_{2\frac{1}{2}}$		
89. 65	HNR	1	305. 39	$b^2D_{1\frac{1}{2}}-u^2D^{\circ}_{1\frac{1}{2}}$		
89. 01	HNR	2	308. 87	$b^2D_{2\frac{1}{2}}-u^2D^{\circ}_{2\frac{1}{2}}$		
80. 27	60	100, I	356. 46	$a^2D_{2\frac{1}{2}}-w^2F^{\circ}_{3\frac{1}{2}}$	(0. 00) 1. 14	(0. 00) 1. 13
71. 14	4		406. 39	$a^4P_{1\frac{1}{2}}-9^{\circ}_{2\frac{1}{2}}$		
67. 74	2		425. 04	$a^2F_{3\frac{1}{2}}-r^2F^{\circ}_{2\frac{1}{2}}$		
62. 35	10	15, II A	454. 66	$a^2D_{2\frac{1}{2}}-v^2F^{\circ}_{2\frac{1}{2}}$	(0. 00 w) 1. 19	(0. 00) 1. 20
56. 92	6	6, III A	484. 58	$a^2P_{1\frac{1}{2}}-v^2P^{\circ}_{1\frac{1}{2}}$	(0. 00) 1. 29 R	(0. 08) 1. 29
38. 59	4	10, III A	586. 13	$a^2D_{2\frac{1}{2}}-z^4S^{\circ}_{1\frac{1}{2}}$		
4, 216. 54	4		709. 47	$a^2D_{2\frac{1}{2}}-x^2D^{\circ}_{1\frac{1}{2}}$		
4, 192. 72	HNR	2	844. 17	$b^2D_{1\frac{1}{2}}-v^2P^{\circ}_{0\frac{1}{2}}$		
87. 31	50	125, I	874. 98	$a^2D_{1\frac{1}{2}}-w^2F^{\circ}_{2\frac{1}{2}}$	(0. 00 w) 1. 16 A[2]	(0. 00) 1. 16 A[2]
77. 48	15	30, I	931. 15	$a^2D_{2\frac{1}{2}}-x^4F^{\circ}_{2\frac{1}{2}}$	(0. 00) 1. 50 (?)	(0. 20) 1. 16
72. 32	6	10, III A	960. 75	$a^4F_{3\frac{1}{2}}-y^4G^{\circ}_{3\frac{1}{2}}$		
71. 13	5	8, III A	23, 967. 58	$a^4F_{4\frac{1}{2}}-y^4G^{\circ}_{4\frac{1}{2}}$		
63. 31	5	8, III A	24, 012. 60	$a^4F_{2\frac{1}{2}}-y^4G^{\circ}_{2\frac{1}{2}}$		
60. 26	20	30, I	030. 21	$a^2D_{2\frac{1}{2}}-x^4D^{\circ}_{3\frac{1}{2}}$	(0. 00 w) 1. 65 w	(0. 00) 1. 67
57. 52	6	10, II A	046. 04	$a^2D_{1\frac{1}{2}}-x^4D^{\circ}_{1\frac{1}{2}}$		

TABLE 6.—*The arc spectrum of lanthanum (La I)*—Continued

λ_{air} I. A.	Intensities, temperature class		ν_{vac} cm^{-1}	Term combination	Zeeman effects	
	B. S.	K. & C.			Observed	Computed
50. 24	2		088. 22	$a^2F_{3\frac{1}{2}}$—$r^2F^{\circ}_{3\frac{1}{2}}$		
44. 36	4		122. 40	$a^4F_{2\frac{1}{2}}$—$y^2G^{\circ}_{3\frac{1}{2}}$		
43. 92	5	12, III A	124. 96	$a^4F_{3\frac{1}{2}}$—$y^2G^{\circ}_{4\frac{1}{2}}$		
37. 05	20	40, I	165. 02	$a^2D_{2\frac{1}{2}}$—$x^2D^{\circ}_{2\frac{1}{2}}$	(0. 00) 1. 22	(0. 09) 1. 23
17. 67	8	20, III	278. 75		(0. 00) 0. 93	
09. 80	10	20, I A	325. 24	$a^2D_{2\frac{1}{2}}$—$v^2F^{\circ}_{3\frac{1}{2}}$	(0. 00) 1. 04	(0. 00) 1. 04
09. 48	6	15, II A	327. 14	$a^2D_{2\frac{1}{2}}$—$x^4F^{\circ}_{3\frac{1}{2}}$	(0. 00) 1. 26	(0. 00) 1. 22
4, 104. 87	30	60, I	354. 46	$a^4F_{1\frac{1}{2}}$—$y^4G^{\circ}_{2\frac{1}{2}}$	(0. 08, 0. 25) 0. 53, 0. 69, 0. 85 ur	(0. 07, 0. 23) 0. 34, 0. 49, 0. 64, 0. 80
4, 090. 40	2		440. 61	$a^2F_{3\frac{1}{2}}$—$u^2D^{\circ}_{2\frac{1}{2}}$		
89. 61	25	50, I	445. 33	$a^4F_{2\frac{1}{2}}$—$y^4G^{\circ}_{3\frac{1}{2}}$	(0. 00) 0. 93	(0. 00) 0. 94
79. 17	20	40, I	507. 90	$a^2D_{1\frac{1}{2}}$—$v^2F^{\circ}_{2\frac{1}{2}}$		
65. 58	15	30, II	589. 82	$a^2D_{2\frac{1}{2}}$—$y^4P^{\circ}_{1\frac{1}{2}}$		
64. 79	25	50, II	594. 60	$a^4F_{3\frac{1}{2}}$—$y^4G^{\circ}_{4\frac{1}{2}}$	(0. 00 w) 1. 03 A^1	(0. 00) 0. 94 A^1
60. 33	30	60, II	621. 61	$a^4F_{4\frac{1}{2}}$—$y^4G^{\circ}_{5\frac{1}{2}}$	(0. 00 w) 1. 10 A^1	(0. 00) 1. 12 A^1
40. 97	2		739. 57	$a^2F_{2\frac{1}{2}}$—$u^2D^{\circ}_{1\frac{1}{2}}$		
37. 21	25	50, I	762. 61	$a^2D_{1\frac{1}{2}}$—$x^2D^{\circ}_{2\frac{1}{2}}$	(0. 00) 0. 86	(0. 13) 0. 84
15. 39	25	50, I	897. 17	$a^2D_{2\frac{1}{2}}$—$x^2P^{\circ}_{2\frac{1}{2}}$	(0. 10, 0. 31) 0. 90, 1. 10, 1. 30, 1. 48 ur	(0. 10, 0.30) 0. 90, 1. 10, 1. 30, 1. 51
4, 001. 38	2		24, 984. 34	$a^2D_{1\frac{1}{2}}$—$x^4F^{\circ}_{2\frac{1}{2}}$		
3, 953. 67	10	40, II	25, 285. 83	$a^2D_{2\frac{1}{2}}$—$y^4P^{\circ}_{3\frac{1}{2}}$		
27. 56	30	80, I	453. 92	$a^2D_{1\frac{1}{2}}$—$x^2P^{\circ}_{0\frac{1}{2}}$	(0. 00) 0. 76	(0. 00) 0. 76
3, 902. 57	5	20, II	616. 91	$a^2D_{1\frac{1}{2}}$—$y^4P^{\circ}_{0\frac{1}{2}}$		
3, 898. 60	8	40, II	25, 642. 99	$a^2D_{1\frac{1}{2}}$—$y^4P^{\circ}_{1\frac{1}{2}}$		
3, 895. 65		8?, IV	25, 662. 42			
3, 714. 30	2		26, 915. 34	$a^2D_{2\frac{1}{2}}$—$w^2D^{\circ}_{1\frac{1}{2}}$		
3, 704. 54	10	40, II	26, 986. 25	$a^2D_{2\frac{1}{2}}$—$u^2F^{\circ}_{3\frac{1}{2}}$	(0. 00) 1. 08	(0. 00) 1. 04
3, 699. 57	4	12, II A	27, 022. 51	$a^2D_{1\frac{1}{2}}$—$y^4G_{2\frac{1}{2}}$		
72. 02	8	30, II	225. 24	$a^2D_{1\frac{1}{2}}$—$w^2P_{1\frac{1}{2}}$		
49. 55	10	40, II	392. 86	$a^2D_{1\frac{1}{2}}$—$u^2F^{\circ}_{2\frac{1}{2}}$	(0. 00) 1. 00	(0. 00) 0. 98
41. 53	20 ?	100, II	453. 19	$a^2D_{2\frac{1}{2}}$—$w^2D^{\circ}_{2\frac{1}{2}}$		
36. 67	6	40, III	489. 88	$a^2D_{2\frac{1}{2}}$—$t^2F^{\circ}_{3\frac{1}{2}}$		
3, 613. 08	10	30, II	669. 36	$a^2D_{1\frac{1}{2}}$—$t^2F^{\circ}_{2\frac{1}{2}}$	(0. 00) 0. 97	(0. 00) 0. 90
3, 574. 43	20	50, II	27, 968. 53	$a^2D_{1\frac{1}{2}}$—$w^2D^{\circ}_{1\frac{1}{2}}$	(0. 00) 0. 83	(0. 17) 0. 85
3, 514. 07	6	20, II A	28, 448. 92	$a^2D_{2\frac{1}{2}}$—$w^4D^{\circ}_{2\frac{1}{2}}$		
3, 480. 61	3	8, III A	722. 40	$a^2D_{2\frac{1}{2}}$—$v^2D^{\circ}_{2\frac{1}{2}}$		
61. 18	10	25, III A	883. 64	$a^2D_{2\frac{1}{2}}$—$7^{\circ}_{1\frac{1}{2}}$		
50. 65	5	12, III A	28, 971. 78	$a^2D_{1\frac{1}{2}}$—$v^2D^{\circ}_{1\frac{1}{2}}$		
3, 404. 53	10	15, III A	29, 364. 24	$a^2D_{2\frac{1}{2}}$—$8^{\circ}_{1\frac{1}{2}}$		
3, 388. 61	6	12, II A	502. 18	$a^2D_{1\frac{1}{2}}$—$w^4D^{\circ}_{2\frac{1}{2}}$		
81. 42		15, II A	564. 92	$a^2D_{1\frac{1}{2}}$—$6^{\circ}_{0\frac{1}{2}}$		
68. 36	3		679. 54	$a^2F_{3\frac{1}{2}}$—11°		
64. 88	2		710. 24	$a^2F_{3\frac{1}{2}}$—10°		
62. 04	7	12, III A	735. 33	$a^2D_{2\frac{1}{2}}$—$s^2F_{2\frac{1}{2}}$		
57. 50	5	7, III A	775. 54	$a^2D_{1\frac{1}{2}}$—$v^2D^{\circ}_{2\frac{1}{2}}$		
49. 82	2	3, III A	843. 80	$a^2D_{2\frac{1}{2}}$—$9^{\circ}_{2\frac{1}{2}}$		
3, 342. 23	10	20, II A	29, 911. 57	$a^2D_{2\frac{1}{2}}$—$s^2F^{\circ}_{3\frac{1}{2}}$	(0. 00) 1. 08	(0. 00) 1. 14
3, 256. 60	2		30, 698. 05			
47. 06	5	8, II A	788. 24	$a^2D_{1\frac{1}{2}}$—$s^2F^{\circ}_{2\frac{1}{2}}$		
35. 66	3	5, III A	30, 896. 71	$a^2D_{1\frac{1}{2}}$—$9^{\circ}_{2\frac{1}{2}}$		
3, 215. 81	10	15, II A	31, 087. 42	$a^2D_{2\frac{1}{2}}$—$r^2F^{\circ}_{3\frac{1}{2}}$	(0.00) 1.13	(0.00) 1.14
3, 179. 78	4	8, III A	439. 65	$a^2D_{2\frac{1}{2}}$—$u^2D^{\circ}_{2\frac{1}{2}}$		
75. 99	8	15, II A	477. 17	$a^2D_{1\frac{1}{2}}$—$r^2F^{\circ}_{2\frac{1}{2}}$		
48. 51	4	4, III A	31, 751. 89	$a^2D_{1\frac{1}{2}}$—$u^2D^{\circ}_{1\frac{1}{2}}$		
3, 109. 42	8	12, II A	32, 151. 04	$a^2D_{2\frac{1}{2}}$—$v^2P^{\circ}_{1\frac{1}{2}}$		
3, 096. 02	8	10, II A	32, 290. 19	$a^2D_{1\frac{1}{2}}$—$v^2P^{\circ}_{0\frac{1}{2}}$		
10. 78	4	2, IV A	33, 204. 34	$a^2D_{1\frac{1}{2}}$—$v^2P^{\circ}_{1\frac{1}{2}}$		
3, 001. 41	2		307. 99			
2, 992. 99	2		33, 401. 69			
09. 65	2		34, 358. 36			
2, 904. 62	1		34, 417. 85			
2, 817. 46	2		35, 482. 54			
2, 794. 03	4		35, 780. 07			
66. 46	4		36, 136. 62	$a^4F_{3\frac{1}{2}}$—13°		
61. 56	7		200. 74	$a^4F_{4\frac{1}{2}}$—14°		

TABLE 6.—*The arc spectrum of lanthanum (La I)*—Continued

λ_{air} I. A.	Intensities, temperature class		ν_{vac} cm^{-1}	Term combination	Zeeman effects	
	B. S.	K. & C.			Observed	Computed
59.54	4		227.24			
56.57	2		266.27			
49.52	2		359.25			
39.25	4		495.56			
37.49	3		519.03			
30.15	2		617.20			
29.85	5		621.22	$a^4F_{2\frac{1}{2}}$—13°		
25.57	15		678.73	$a^2D_{2\frac{1}{2}}$—11°		
22.31	6		722.65	$a^2D_{1\frac{1}{2}}$—10°		
17.33	2		789.90			
15.77	3		811.08			
14.52	8		828.03	$a^4F_{3\frac{1}{2}}$—14°		
10.69	4		880.06			
2,707.07	3		36,929.38	$a^4F_{1\frac{1}{2}}$—12°		
2,684.11	6		37,245.25			
77.77	2		333.43	$a^4F_{2\frac{1}{2}}$—15°		
71.91	2		415.30			
53.48	2		675.16	$a^4F_{1\frac{1}{2}}$—15°		
47.13	2		765.53			

V. IONIZATION POTENTIALS OF LANTHANUM ATOMS

The first two members of series have been identified in the spectra of lanthanum in all three degrees of ionization, and the ionization potentials for three different lanthanum atoms, La, La$^+$, La^{++}, may thus be deduced spectroscopically from extrapolation of the series to their limits.

To use the Rydberg formula is equivalent to assuming that the denominator n^* changes by exactly 1 from one term to the next in a series. In those spectra for which long series and accurate limits are available, the change Δn^* between the first and second members is usually somewhat greater and it appears to be preferable to assume that the value for lanthanum is comparable with that for similar spectra. For example, in the 1-electron spectra we find the following values of Δn^* for the *s* electron:

K I	Ca II	Rb I	Sr II	Cs I	Ba II
1.031	1.033	1.040	1.042	1.050	1.052

We may therefore assume $\Delta n^* = 1.050$ for La III. The terms 6^2S and 7^2S then give a limit at 154,630 (above the lowest level $^2D_{1\frac{1}{2}}$) with $n^* = 2.6462$, 3.6962. This corresponds to an ionization potential of 19.07 volts which is the lowest known value for a third ionization. Badami[26] from his analysis of this spectrum derived 20.4 volts for the ionization potential of La^{++}.

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[26] J. S. Badami, Proc. Phys. Soc. London, vol. 43, p. 53, 1931.

For 2-electron spectra we find for the ^{3}S and ^{3}D terms due to "running" *s* and *d* electrons:

Term	^{3}S			^{3}D		
Spectrum	Ca I	Sr I	Ba I	Ca I	Sr I	Ba I
Δn^*	1. 040	1. 042	1. 045	1. 135	1. 181	1. 289

The ^{1}S and ^{1}D series in the alkaline earths are too much perturbed [27] to be of use. We therefore assume that in La II $\Delta n^* = 1.05$ for a running *s* electron; that is, for the terms a^{3}D, f^{3}D, and a^{1}D, f^{1}D, with limit 5^{2}D in La III, and 1.15 for a running *d* electron (a^{3}D, h^{3}D with limit 6^{2}S). The resulting values of n^* (referred to the proper limit for each component) and of the difference between the lowest level in La II ($a^{3}F_{2}$) and La III ($5^{2}D_{1\frac{1}{2}}$) are as follows:

Term	$^{3}D_{1}$	$^{3}D_{2}$	$^{3}D_{3}$	$^{1}D_{1}$	$^{3}D_{1}$	$^{3}D_{2}$	$^{3}D_{3}$
n^*	2, 2232 3, 2732	2, 2333 3, 2833	2, 2206 3, 2706	2, 1826 3, 2326	2, 0384 3, 1884	2, 0453 3, 1953	2, 0518 3, 2018
Limit	90, 704	90, 600	90, 664	91, 924	93, 944	93, 924	93, 916

The mean of these seven values is 92,240, which corresponds to an ionization potential of 11.38 volts for La^{+}.

Finally, for La I, we have the terms a^{4}F, e^{4}F and a^{2}F, e^{2}F with a running *s* electron and limit a^{3}F of La II. With limit a^{3}D we have only a^{2}D and e^{4}D, but these terms, though of different multiplicity, may still be used.[28] The first comes from the configuration $5d\ 6s^{2}$, the second from $5d\ 6s\ 7s$. Dropping the $5d$ electron we obtain the lowest ^{1}S and ^{3}S terms in Ba I. For these and the corresponding terms in Ca I and Sr I we have the values of n^*.

Spectrum	Ca I	Sr I	Ba I
$n^*(^{1}S)$	1. 442	1. 545	1. 616
$n^*(^{3}S)$	2. 484	2. 548	2. 629
Δn^*	1. 042	1. 003	1. 013

We may, therefore, adopt $\Delta n^* = 1.010$ in this case while in the others we use 1.060. We then find

Term	$a^{2}D_{2\frac{1}{2}}$ $e^{4}D_{3\frac{1}{2}}$	$a^{4}F_{1\frac{1}{2}}$ $d^{4}F_{1\frac{1}{2}}$	$a^{4}F_{2\frac{1}{2}}$ $e^{4}F_{2\frac{1}{2}}$	$a^{4}F_{3\frac{1}{2}}$ $e^{4}F_{3\frac{1}{2}}$	$a^{4}F_{4\frac{1}{2}}$ $e^{4}F_{4\frac{1}{2}}$	$a^{2}F_{2\frac{1}{2}}$ $e^{2}F_{2\frac{1}{2}}$	$a^{2}F_{3\frac{1}{2}}$ $e^{2}F_{3\frac{1}{2}}$
n^*	1. 5221 2. 5321	1. 6033 2. 6633	1. 6000 2. 6600	1. 5948 2. 6548	1. 5892 2. 6492	1. 6829 2. 7429	1. 6855 2. 7455
Limit	45, 145	45, 337	45, 856	45, 606	45, 583	44, 721	44, 687

The mean is 45,293 for the interval from $a^{2}D_{1\frac{1}{2}}$ (La I) to $a^{3}F_{2}$ (La II). This corresponds to an ionization potential of 5.59 volts.

A change of +0.01 in Δn^* alters the computed limits on the average by −152 or −0.019 volts. The average discordance of the seven determinations from the mean is ±334 or ±0.041 volts. We, therefore, adopt 5.59±0.03 volts as the first ionization potential of lanthanum. This is in excellent agreement with the value 5.49 volts derived by Rolla and Piccardi[29] from observations of the ionization current and rate of dissociation of La_2O_3 in flames.

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[27] A. G. Shenstone and H. N. Russell, Phys. Rev., vol. 39, p. 415, 1932.

[28] We owe this suggestion to Prof. A. G. Shenstone.

For La II a change in Δn^* by ±0.01 affects the ionization potential by ±0.044 volts, while the average discordance of one determination is ±0.13 volts.

We may finally adopt for lanthanum atoms:

First ionization potential = 5.59±0.03 volts.
Second ionization potential = 11.38±0.07 volts.
Third ionization potential = 19.1 ±0.1 volts.

VI. DISCUSSION OF ZEEMAN EFFECTS

The observed Zeeman effects for lanthanum lines in all three spectra positively identify most of the spectral terms although a comparison of the observed and theoretical g values discloses many discrepancies which greatly exceed the experimental errors. Similar deviations have been observed in other spectra, and have been assigned either to departures from strict SL coupling, or to the sharing of g values by mutually perturbing terms. If the coupling between spin moment and orbital moment of each electron is weak individually as compared with the coupling of the spins and those of the orbital moments of the electrons mutually we have the so-called SL coupling:

$$\{(s_1\ s_2 \text{----})\ (l_1\ l_2 \text{----})\} = (SL) = J$$

An atom for which this is true will emit a spectrum in which interval rules, and Zeeman effects are in accord with the values predicted by the theory of Landé and others. But if the quantum vectors s and l are actually compounded to produce a resultant vector J in some other manner the spectrum will show violations of the interval rules and deviations from Landé's g values. Such deviations are evident in the La spectra. For example, the metastable quartet-F term in the La I spectrum shows only a slight departure from the interval rule:

	Separations	Ratios
Theoretical	$^4F_{4\frac{1}{2}}-{}^4F_{3\frac{1}{2}}:{}^4F_{3\frac{1}{2}}-{}^4F_{2\frac{1}{2}}:{}^4F_{2\frac{1}{2}}-{}^4F_{1\frac{1}{2}}=$	9.00:7.00:5.00
La I	627.0 : 484.6 : 341.8 =	9.00:6.95:4.90

and the observed g values are almost exactly those of Landé

Level	Observed g	Landé g
$^4F_{1\frac{1}{2}}$	0.411	0.400
$^4F_{2\frac{1}{2}}$	1.032	1.029
$^4F_{3\frac{1}{2}}$	1.222	1.238
$^4F_{4\frac{1}{2}}$	1.337	1.333

The low terms in the La II spectrum do greater violence to the interval rule, and also somewhat larger divergences of observed and theoretical

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[29] L. Rolla and G. Piccardi, Phil. Mag., vol. 7, p. 286, 1929.

g values occur. Thus, for the normal state represented by a^3F we have the following interval ratios:

	Separations	Ratios
Theoretical	$^3F_4-^3F_3:^3F_3-^3F_2$	4.00:3.00
La II	954.6 : 1016.1	4.00:4.26

and the following g values:

Level	Observed g	Landé g
$^3F_2$	0.730	0.667
$^3F_3$	1.092	1.083
$^3F_4$	1.258	1.250

Similarly for the term a^3D, the interval ratios are:

	Separations	Ratios
Theoretical	$^3D_3-^3D_2:^3D_2-^3D_1$	3.00:2.00
La II	658.8:696.4	3.00:3.17

and the splitting factors are:

Level	Observed g	Landé
$^3D_1$	0.520	0.500
$^3D_2$	1.140	1.167
$^3D_3$	1.337	1.333

These, and many other departures from theoretical values indicate a considerable deviation from (SL) coupling, probably in the direction of (jj) coupling defined, in the case of two electrons, by

$$\{(s_1l_1)\ (s_2l_2)\} = (j_1j_2) = J$$

in which the interactions between spin and orbital moment of each electron predominate.

No matter what the nature of the coupling may be the so-called g-sum rule of Pauli[30] is expected to be valid. This rule can be stated as follows: If, among all the terms arising through the coupling of one electron, those terms with the same inner quantum number J be grouped, the sum of the g values of the terms in each group must have a value independent of the nature of the coupling, and consequently is, among others, equal to the sum of the Landé g values for a similar group. This rule is tested in Table 7 where the observed and Landé g sums are displayed for all the groups in La II for which the data are complete and for the low terms in La I, although one term has not been found. The sums of observed g values are slightly larger than the theoretical sums, but the differences can perhaps be ascribed to the accumulation of a small systematic error of observation. If the observered g's are diminished by 0.78 per cent, to allow for this, the agreement becomes almost perfect, with an average discordance of only 0.5 per cent.

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[30] W. Pauli, Zeits. f. Phys., vol. 16, p. 155, 1923.

TABLE 7.—*Zeeman effect: Sums of adopted and Landé g values*

La II

Electrons	Terms \ J	6		5		4		3		2		1		Sum	
		Adopted	Landé	Adopted	Landé	Adopted	Landé	Adopted	Landé	Adopted	Landé	Adopted	Landé	Adopted	Landé
ds	a^3D							1.337	1.333	1.140	1.167	0.520	0.500	2.997	3.000
	a^1D									.987	1.000			.987	1.000
d^2	a^3F					1.258	1.250	1.092	1.083	.730	.667			3.080	3.000
	a^3P									1.488	1.500	1.506	1.500	2.994	3.000
	a^1G					1.003	1.000							1.003	1.000
	b^1D									1.015	1.000			1.015	1.000
Sum low terms						2.261	2.250	2.429	2.416	5.360	5.334	2.026	2.000	12.076	12.000
pf	c^3G			1.203	1.200	1.146	1.050	.873	.750					3.222	3.000
	e^3F					1.141	1.250	1.061	1.083	.732	.667			2.934	3.000
	c^3D							1.306	1.333	1.100	1.167	.495	.500	2.901	3.000
	e^1G					1.060	1.000							1.060	1.000
	e^1F							.953	1.000					.953	1.000
	e^1D									1.046	1.000			1.046	1.000
ds	f^3D							1.331	1.333	1.141	1.167	.520	.500	2.992	3.000
	f^1D									1.020	1.000			1.020	1.000
Sum all even terms				1.203	1.200	5.608	5.550	7.953	7.916	10.399	10.335	3.041	3.000	28.204	28.000
sf	z^3F					1.26	1.25	1.09	1.08	.67	.67			3.02	3.00
	z^1F							1.05	1.00					1.05	1.00
df	z^3H	1.17	1.17	1.08	1.03	.86	.80							3.11	3.00
	z^3G			1.20	1.20	1.06	1.05	.77	.75					3.03	3.00
	y^3F					1.24	1.25	1.09	1.08	.76	.67			3.09	3.00
	z^3D							1.32	1.33	1.19	1.17	.55	.50	3.06	3.00
	z^3P									1.46	1.50	1.46	1.50	2.92	3.00
	z^1H			1.00	1.00									1.00	1.00
	z^1G					1.00	1.00							1.00	1.00
	y^1F							1.03	1.00					1.03	1.00
	z^1D									.93	1.00			.93	1.00
	z^1P											.88	1.00	.88	1.00
dp	x^3F					1.25	1.25	1.08	1.08	.84	.67			3.17	3.00
	y^3D							1.31	1.33	1.19	1.17	.80	.50	3.30	3.00
	y^3P									1.49	1.50	1.26	1.50	2.75	3.00
	x^1F							1.06	1.00					1.06	1.00
	y^1D									.90	1.00			.90	1.00
	y^1P											1.07	1.00	1.07	1.00
ds	x^3P									1.48	1.50	1.52	1.50	3.00	3.00
	x^1P											.97	1.00	.97	1.00
Sum all odd terms		1.17	1.17	3.28	3.23	6.67	6.60	9.80	9.66	10.91	10.84	8.51	8.50	40.34	40.00

TABLE 7.—*Zeeman effect: Sums of adopted and Landé g values*—Continued

La I

J		4½		3½		2½		1½		½		Sum	
Electrons	Terms	Adopted	Landé	Adopted	Landé	Adopted	Landé	Adopted	Landé	Adopted	Landé	Adopted	Landé
ds^2	a^2D					1.20	1.20	0.79	0.80			1.99	2.00
d^2s	a^4F	1.33	1.33	1.22	1.24	1.03	1.03	.41	.40			3.99	4.00
	a^4P					1.54	1.60	1.69	1.73	2.71	2.67	5.94	6.00
	a^2G	1.12	1.11	.91	.89							2.03	2.00
	a^2F			1.13	1.14	.90	.86					2.03	2.00
	b^2D					1.29	1.20	.89	.80			2.18	2.00
	a^2P							1.32	1.33	.67	.67	1.99	2.00
	^{2}S									(2.00)	2.00	(2.00)	2.00
Sum low terms		2.45	2.44	3.26	3.27	5.96	5.89	4.31	4.26	3.38	3.34	20.15	20.00

WASHINGTON, August 6, 1932.